

# PUBLIC WORKS

*Devoted to the interests of the engineers and technical  
officials of the cities, counties and states*

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## TIMEWASTERS

Shaking the dust of the sidewalks of New York from our feet for a time, which means that this serio-comic column must be prepared before the returns are in from the distant precincts reached by the October issue. Therefore, the burning problem of Ikey and Mikey and the distance that separates them must be held over. However, another entrant sends in a solution checking Mr. Bevan on his 6.27 feet per second. This is J. A. Conklin from New Jersey. Thank you, Mr. Conklin. We hate even to entertain the thought, but did Messrs. Blunk and Vinson slip up on this?

Now the problem of the marching men — one of whom took a drink of beer, and then there were nine, in the rear rank—should be settled before Armistice Day. It is really a good problem. The men were marching 10 abreast; one man fell out of the rear rank; thereafter, no matter whether the ranks were rearranged to have, 9, 8, 7, 6, 5, 4, 3, or 2 men in a rank, there was always a vacant file in the last rank. How many men were there in the army?

We can eliminate 2, 3, 4 and 6 since they will divide into any number that 9, 8, 7 and 5 will combine to form. Therefore the number of men in the army was  $9 \times 8 \times 7 \times 5$ , or 2,520. When the beer-drinker beat it (went over the hill), 2,519 were left, which meets the requirements.

### An Easy One:

Here is quite a common word of eleven letters. The first three letters and the last three are the same, and arranged in the same order. Here is a part of it: --- E R G R O ---. What is the word? *Cleo F. Craig*

### The Concrete Gang:

A gang of men were mixing concrete for an Imhoff tank. When mixing started at 10 a. m., there were a number of bags of cement on hand. At 11 a. m., some of these still remained, and at that hour, the truck brought twice as many bags as were on hand. During the hour from 11 to 12, as many bags were used as during the first hour, but at 12 noon, the truck delivered three times as many bags as were on hand. Work then ceased for dinner, but was resumed at 1 p. m. During the hour from 1 to 2, the same number of bags were used as from 10 to 11 and 11 to 12, and at 2 p. m. along came the truck with four times as many bags as remained on hand. From 2 to 3 consumption was just the same as for the preceding hour, but at 3 p. m. the truck delivered 5 times as many as were on hand. The mixer gang then speeded up their work, so that in the hour from 3 to 4 as much cement was used as in the entire previous four hours; and when the gang quit work at 4 p. m., there was no cement left. How many bags were there to begin with, and how many were used during the final hour? *W. A. H.*

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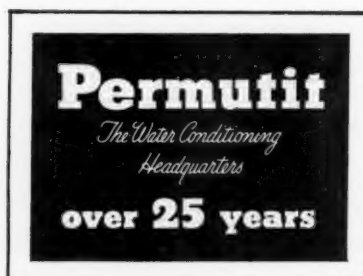
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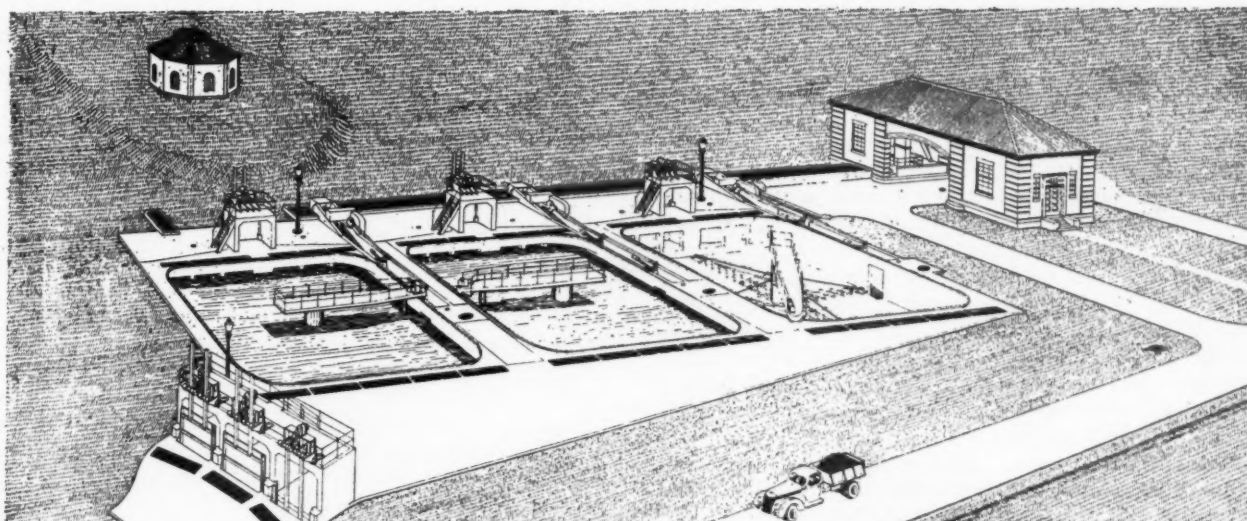
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Aerial perspective of grit removal structure for Back River Sewage Treatment Works

## Designing a Grit Removing Plant

By A. RUSSELL VOLLMER

**T**HE Back River Sewage Treatment Works of Baltimore, Md., which was first placed in operation in 1911, has always been notable for keeping abreast of the times in both design and operation. Improvements are continually being made, many of them based on experiments conducted

at the plant. A construction program is now under way which, when completed, will give a plant which includes grit chambers, activated sludge works, elutriation and vacuum filtering of sludge, with increased capacity for primary sedimentation and sludge digestion.

The design of the grit chambers was based on a comprehensive study of the subject; and the detailed procedure followed by the designing engineer, A. Russell Vollmer of Whitman, Requardt and Smith, in developing the plans will, we believe, be of interest and value to designers of such plants because of new factors introduced by the use of modern equipment, and because such procedure has by no means become standardized. Mr. Vollmer described the procedure followed in preparing the Baltimore plans in a paper before the Maryland-Delaware Water and Sewerage Association; which paper, somewhat abbreviated, is given below.

**The designing of grit-removal plants has by no means been standardized. The use of mechanical equipment for removing and cleaning the grit has considerably simplified such designing, but has introduced modifications in some of the ideas previously employed as a basis of design. This article describes in detail how a leading engineering firm designed a plant for using such equipment.**

The average daily flow at this plant in 1937 was 86.76 mgd, but it reached an instantaneous peak rate of 242.5 mgd. Peaks of 200 mgd are not uncommon during storms. The system is not a combined one, and these peaks are presumably due to storm water entering at unintended places. This storm water

brings with it considerable grit, averaging 237 cu. yd. a year; sufficient at times to stop the rotating sludge collectors in the tanks, and clog the sludge pipes. The grit chambers have been designed for a maximum flow of 300 mgd.

Mechanism for continuous removal of grit and washing it have been developed by several manufacturers of sewage treatment machinery, and use of it permits features of design not otherwise practicable. It makes it less imperative to maintain horizontal tank velocities for all flows at a figure which would prevent deposition of excessive amounts of organic solids, and eliminates the necessity to provide grit storage space as part of the tank volume.

These advantages, along with easy adaptation to automatic control, minimum increase in operating per-



sonnel and continuous service without the necessity to by-pass tanks for periodic cleaning, led to the adoption of the continuous removal type of tank for the Back River Plant.

### Sedimentation

In sewage works, sedimentation is utilized to remove suspended solids varying in size from colloids to larger than 1.00 mm. in diameter and varying in specific gravity from roughly 1.2 for organic solids to 2.65 for mineral solids. In grit chambers the objective is to remove only mineral particles having relatively high subsiding velocities. The detention period is short and the horizontal velocity comparatively high. Under these conditions, grit particles settle and most of the higher, less readily settleable organic solids are carried through the chambers to other treatment processes.

The subsiding velocity of an individual particle is determined mainly by its size and its density, together with the viscosity and density of the liquid through which it settles. A beginning point for the discussion of sedimentation as it applies to sewage treatment is the action of particles in still water. The subsiding velocities of particles commonly found in sewage have been found to fall into three broad classifications, dependent upon particle size. For particles less than 0.10 mm. (approximate) in diameter the velocity is influenced mainly by the viscosity of the liquid. The subsiding velocities of particles over 1.00 mm. (approximate) in diameter are influenced mainly by the frictional resistance of the liquid. Between these two classifications is a transition region where both viscosity and friction are effective.

Sewage grit falls within comparatively narrow limits of size and specific gravity. This material is composed mainly of sand and mineral particles ranging in size from approximately 0.10 mm. to larger than 1.00 mm. with a specific gravity of 2.65. Particles of other sizes and specific gravities are, of course, deposited in varying amounts along with the grit. While all settled material must be handled, this design does not include the settling characteristics of materials other than the grit. Sewage grit is almost wholly within the transition region mentioned previously, and discussion in this paper will be confined to the action of particles within that classification. Hazen made a careful study of the settling of quartz grains and reported subsiding velocities which have been checked subsequently by other investigators. Table I gives the subsiding velocities of quartz grains from 0.10 to 1.00 mm. in diameter settling in still water at 60°F. These values, based on experimental data by Hazen, were used in the design of the Back River chambers.

The development of theoretical sedimentation expressions is based on several assumptions, which are made to clarify the approach and simplify the problem. The assumptions may be stated as follows:

Table I. Subsiding Velocities of Quartz Grains in Still Water

Diameter of Particle		Subsiding Velocity at 60° F	
inches	mm.	mm. per sec.	feet per sec.
.039	1.00	117	.383
.031	.80	97	.317
.024	.60	73	.241
.020	.50	62	.203
.016	.40	49	.161
.012	.30	37	.122
.008	.20	24	.080
.006	.15	17	.057
.004	.10	9	.030

(1) All particles maintain their shape, size and individuality during settlement. Each individual particle settles at constant velocity without interference.

(2) When a particle of sediment reaches the bottom, it is removed from the basin.

(3) The direction of sewage flow is horizontal, and the velocity is the same in all parts of the basin.

(4) Particles of each size are evenly distributed from top to bottom throughout the incoming sewage.

It is apparent that any mathematical expressions for the removal of sediment based on the above assumptions can be completely true only for an "ideal" basin. It is also true that such assumptions can be more properly applied to the settling of grit particles than to the settling of lighter organic solids. In primary and secondary sedimentation tanks the effect of flocculation and coagulation, the presence of a sludge blanket and the effect of vertical mixing and temperature currents on particles of low subsiding velocities tend to destroy the basic assumptions. In grit chambers it can be assumed with reason that particles are substantially free from coagulation. Once particles reach the bottom they tend to remain there. Actually, little is known about velocities along tank bottoms, but Metcalf and Eddy have stated that once a particle reaches the bottom, velocities from thirty to forty times the subsiding velocity are required to pick it up and move it along. The velocity distribution and direction of flow in the tank largely depend upon inlet and outlet conditions. Careful design is required to insure favorable settling conditions throughout the tank. The distribution of grit particles in the influent is variable and uncertain. To assume uniform distribution from top to bottom is conservative.

In the design of any sedimentation tank it is reasonable to require that the detention period for a given flow be at least sufficient to allow particles, for which removal is desired, time to settle from top to bottom. Under "ideal" conditions and in accordance with the foregoing assumptions, if the time required for any one particle to settle from top to bottom is equal to the detention period, particles of that size will be exactly one hundred percent removed, and they will be equally distributed over the tank bottom. Further, since the subsiding velocity for each individual particle is constant, those particles having a greater subsiding velocity will be one hundred percent removed in a shorter period and particles having lesser velocities will be removed in the ratio that their time of setting bears to the detention period. Hazen has pointed out that these removal proportions are a function of the area of the basin. For a given area and quantity of flow, the deposition of particles is independent of the depth. Of course, depths cannot be so shallow that high horizontal velocities prevent the deposit of sediment.

The mathematical development of the foregoing statements for the removal of sediment in an ideal basin may be demonstrated as follows: Hazen's original notation has been retained.

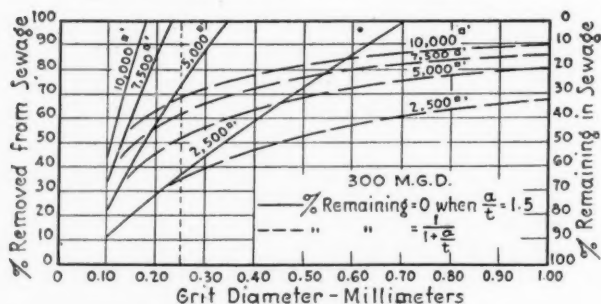


Fig. 1—Comparative tank performance



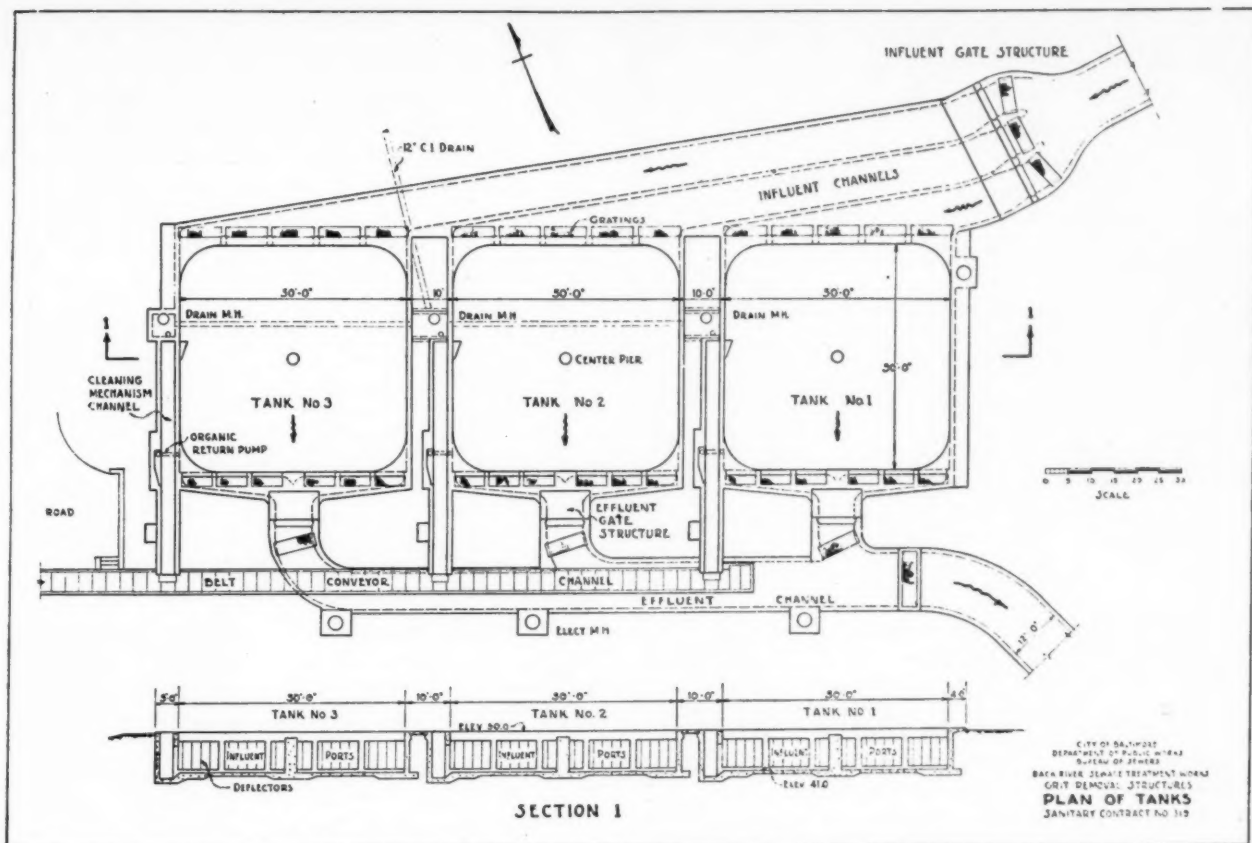


Fig. 2—Plan and section of tanks, Back River grit removal structures

If  $a$  = detention period =  $\frac{\text{capacity of basin}}{\text{quantity per unit of time}}$

$b$  = basin area       $e$  = quantity treated per time unit

$h$  = depth       $v$  = subsiding velocity

$c$  = capacity       $t$  = time required for one particle to settle from top to bottom

$\frac{a}{t}$  = detention period in terms of time required for one particle to settle from top to bottom

Then  $a = \frac{c}{e} = \frac{bh}{e}$

$t = \frac{h}{v}$

$\frac{a}{t} = \frac{e}{h} = \frac{bv}{e}$

Values for  $\frac{a}{t}$  are thus independent of the depth, and they may be computed for a given flow and particle size if a definite area is assumed. Values for  $\frac{bv}{e}$  which make  $\frac{a}{t}$  equal to or greater than 1.00 indicate one hundred per cent removal in an ideal basin, and values which make  $\frac{a}{t}$  less than 1.00 indicate partial removal in that same proportion. In an actual basin, the removal of grit may be considered to be some function of  $\frac{a}{t}$ .

For the design of the Back River tanks, one hundred percent removal was assumed when  $\frac{a}{t}$  values were equal to or greater than 1.5. This meant that detention periods at least fifty percent longer than the theoretical time for one particle to settle from top to bottom were considered necessary to reach one hundred percent removal.

One other expression was used in comparing sedimentation characteristics. For one basin operating continuously, with liquid being admitted at one place and drawn off at another, Hazen developed the expression "the proportion of sediment remaining in the liquid after the process =  $\frac{1}{1 + \frac{a}{t}}$ ." This formula

is based on the assumptions that the density of suspended matter is kept the same in all parts of the basin by mixing and that the density of sediment in the mixture is the same as it is in the effluent. The mathematical development of this relation is given in Hazen's original paper. The assumptions for this formula are difficult to reconcile with the rational development of sedimentation theory previously described for an ideal basin. Mixing such as is assumed would require violent agitation to maintain grit in such a state of suspension. It is believed that Hazen based this formula on observations which indicated no definite increase in particle concentration with depth in a tank which was handling a suspension of much lighter and smaller particles than are encountered in grit chambers. This relation was calculated and used as a lower limit of basin performance.

#### Specific Design

It was estimated that the probable installed basin area of the Baltimore tanks would be less than 10,000 square feet. Table 2 was prepared to show  $\frac{a}{t}$  values for various grit sizes in basins of 10,000 square foot area and smaller with flows of 300 mgd. The figures were obtained by dividing the basin area (in square feet) by the quantity treated (in cubic feet per second)

(Continued on page 28)



Rotary plow widening a lane made by a V-plow

# Open Roads

BY SQUIRE E. FITCH

County Highway Superintendent,  
Chautauqua County, New York

**G**EOGRAPHIC conditions in Chautauqua County, New York, result in what we call the "snow belt"—a strip about 10 miles wide by 40 miles long, parallel to and about 5 miles inland from Lake Erie. In this belt the annual snow fall is easily three times that in other parts of the county (which averages about 92 inches a year), as is also the wind. In fact, it is the west winds, sweeping across 100 miles of Lake Erie, that are responsible for the snow belt; aided by the 1,000-foot hills near the lake shore, which throw these warm, moist winds into the colder air above them. It is quite common for a blizzard to howl in the snow belt while golfers are enjoying rather mild weather in the southern part of the county.

We have therefore worked out a system of plowing designed to fit these diversified conditions; also a system of directing the work from a central station. We have learned, in our 15 years of snow handling, that if we simply station trucks strategically throughout the county, with definite routes for the drivers to plow at their own initiative, the initiatives vary and one truck will be overworked while another is idle. To avoid this and minimize the amount of equipment needed, we have developed a system of central dispatching for all units.

A dispatcher is on duty in our shop, day and night, all through the winter, his duties being so arranged that he can keep one eye on the weather at all times and take up his dispatching duties at the first sign of storm any place in the county. So that he can receive immediate information of a threatened snow storm at any part of the county, the department contracts with all night service and bus stations in all parts of the county to telephone the dispatcher (reversing charges) whenever snow threatens. If the dispatcher thinks plowing is needed, he calls the regular patrolman nearest the danger point and instructs him to take out a light scouting plow mounted on a 1½-ton truck, and telephone to headquarters detailed information about the storm. When the dispatcher thinks the light trucks can not handle the situation, he sends out as many of the nearby heavy plows as may be needed.

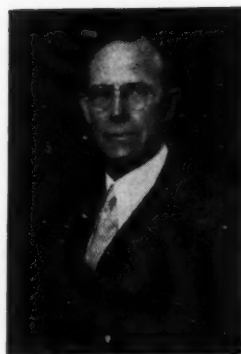
Drivers of all snow plows, on reaching designated points in their plowing, telephone to headquarters information about the storm and how the plowing is progressing, and also receive further orders. These reports are recorded in a log book, together with the mileage, time of calling, driver's name, number of his truck, and

any other information necessary to a complete record of the work in each sector. This permits keeping a separate account of the cost of removing snow from the State road, or primary system, which we must do to obtain payments to us by the State of 50% of such cost. These driver's reports also permit us to give up-to-the-minute storm information to newspapers, automobile clubs and travelers.

To insure speed in the sending of these reports to headquarters, we have an unlisted telephone wire to our office, the number of which is known only to our drivers and employees. We considered using two-way radio service to permit direct communication between the dispatcher and the drivers. But apparently no such system is yet practicable over a distance of more than 5 or 6 miles. Also, a 2-way set for each truck would cost about \$950 and the central transmitting station \$4,000—too much for the value given; and a one-way set would have little advantage over the present system, as the driver would have to telephone his reports in anyhow.

When snow conditions are bad, be it day or night, the superintendent of construction travels the highways in a fast automobile, conducting the work and keeping the dispatcher informed more thoroughly of general conditions, making possible more team work between the various units, and keeping the men on their toes as they never know where or when he will show up.

To make conditions throughout the county apparent to the dispatcher at a glance and help him keep an accurate check on all equipment during a storm, a large map of all roads to be plowed is mounted on a soft wood board in his office. The mileages between points marked on this map help him apportion the snow fighting work evenly. Each truck's position is indicated by a large white-headed tack marked with the truck's number and an arrow showing the direction it is traveling, the tack being changed as each report comes in from the driver. Also, when the relief dispatcher comes on duty, a glance at map and log book tells him exactly how the campaign against snow-blocked highways is being carried on.



Squire E. Fitch

# dsin New York's Snow Belt

**In a county where golfers are sporting in one part while plows are bucking drifts in a howling blizzard in another, special methods of control, so that all equipment is kept working where most needed, are necessary—and Chautauqua County has them.**

Red tacks are used to mark both ends of highways in need of plowing at any given time. A written description may be fastened by a red tack to any part of the map where a special condition calls for more than ordinary attention. A traffic map of the county is carried by each driver in his cab to help him understand his orders.

The highways in the county are divided into two classifications, according to importance. Primary roads, which receive first consideration, are the 296 miles of the State highway system; on these the county receives State aid in snow removal. After they have been cleared we use the same equipment on the secondary roads. It is seldom that a storm is bad enough to confine all plows to primary roads. On even the smallest of the less important roads, traffic is never stopped for more than a few hours. But the cost of snow removal is reduced tremendously—half that of some districts of comparable size and climate.

We now plow 563 miles, or about 30% of the total highway mileage in the county. The average cost, over a period of years, has been \$72 per mile per year; this figure including all snow fence charges, purchase and hauling of cinders, and machinery rental at rates established by the State Highway Department. The costs per mile-trip vary from 10c. for light trucks under mild conditions, to 30c. for heavy trucks under bad conditions.

## Equipment

The trucks used for pushing the plows are those used in regular construction work in the summer. Some are county owned, stationed mostly at headquarters, and are generally the first sent out. To supplement these, a considerable number of privately owned dump trucks



Plow mounted on a county truck



Inspecting a partly opened road

are hired in summer, and in winter are stationed at strategic points over the county, equipped with county-owned plows. If a truck is stationed where the owner does not live, he is allowed a flat monthly rate, just sufficient to garage it, with an hourly stipend, based on the size of the truck, when it is used. As the truck would otherwise be idle most of the winter, he is glad to do this, arranging to have a driver available on phone call at all times; and investment in county-owned equipment is kept to a minimum.

Our equipment consists of 22 heavy-duty steel V-plows suitable for 4 or 5-ton trucks; 6 V plows for 1½-ton trucks; and a one-way blade plow. Also two rotary plows ("Sno-Go") for emergency work and for widening the lanes made by the V-plows.

Most economical of our equipment are the 1½-ton trucks. They are light and fast, capable of undelayed quick work, and do not throw up ridges as the slower ones do, for the speed spreads the snow farther away from the road bed. Replowing with heavier equipment or rotaries is frequently unnecessary, if the snow is light enough for the light equipment or falls so slowly that they can keep up with it. The points on these trucks weigh 640 lbs., and push arms, a light wing on the



side, fastenings, etc., bring the total weight to about 1100 lbs. These are the plows used on the scouting trucks sent first to the danger areas to remove as much snow as possible and post the snow dispatcher on snow conditions. They are not too heavy for the light maintenance trucks to handle, leave no ridge and can often control snows alone. The 1½-ton trucks plow for about 13 cts. per mile-trip, and are easily operated.

Plows for the 4- and 5-ton trucks weigh about 2650 lbs., 1700 lbs. in the point. They cost approximately twice as much per mile to operate as do the smaller ones and are used only when necessary, but must be available when the snowfall is too rapid for the light equipment.

Four-wheel-drive trucks some years ago required frequent expensive repairs, but recent designs are more sturdy. They have considerable advantage over ordinary trucks in heavy snow work, but we believe that when plowing becomes too heavy for a 5-ton pneumatic-tired truck it becomes at once a job for a rotary plow—we can see but a small field for intermediate equipment.

Before 1928 we used 10-ton caterpillars fitted with plows to push back ridges. We did not dare leave the ridges for long, for a thaw followed by freezing weather would ice them so hard that none of our equipment would move them. We bought a rotary in 1928 and another in 1936 and now use no tractors for snow removal, their cruising speed is too low and they are expensive to operate.

The rotaries will remove any kind of snow that is not actually ice and throw it about 100 ft. on either side of the road, without obscuring the driver's vision. Their value lies not so much in ordinary plowing as in their availability for emergencies and their practicability in removing ridges shoved up by the push plows, which removal is necessary when it appears another storm may fill the road again. They travel 20 to 30 miles an hour to and from assignments, and plow at the rate of 2 miles an hour.

Since we know that they can quickly reach roadside ridges left by V-plows in case another storm threatens, we dare wait longer before sending them out. It therefore oftentimes is possible to delay removal of ridges until they have melted, thus saving the cost of their removal; the rotaries thus saving us money even if they don't go out of the garage.

Our machine repair shop is modern, equipped with an overhead traveling crane and hoists, a lathe, drills, presses, forges, and complete acetylene and electric welding apparatus. Machine and steel construction work of almost any kind is possible there, and during the past few years we have built our own steel plows. Different snow conditions demand different types of plows, and we can meet the exact requirements of Chautauqua County most accurately by making our plows ourselves.

All our plows are fitted with interchangeable cutting edges of abrasion steel, beveled, cut and punched so that they can be reversed. Special care is taken in bracing the bottoms of the plows to insure maximum strength, and weight is minimized by constructing the tops, where there is less strain, of lighter steel and with just enough curve to keep snow from obscuring the windshield when plowing at the proper speed. Wings are generally of wood bolted to iron ribs and attached to the plow point by a 2-way joint that allows them to be spread at varying angles and to float up without breaking if the going gets too heavy or obstacles are encountered.

The push arms are attached to the truck frame in the middle and the point is kept as close to the ground as possible without reducing the flexibility of the truck's steering apparatus. The plow rides on replaceable runners, set close to the ground, or it may be carried off the ground in transit.

Plows and wings with hydraulic control have considerable advantage in speed over manual control, but their additional cost is considerable. On the modern dump trucks with a holding device on the hoist, we use the dump hoist for raising the plow point. This is done by attaching a cable to the front of the body on each side and running each over two sheaves to the plow point. These are so arranged that when the plow is raised to the desired maximum height, another cable, attached to the body, disengages the hoist control so it will not go too high and cause breakage.

The lights which trucks must carry on the highways are prescribed by law, varying only slightly from state to state. In addition to lights required by New York State regulations, our plows are equipped with lights fixed to extension arms, fastened across the top of the cab. These lights show red toward the rear, green toward the front. When a truck is plowing, the arms are pushed out so that the lights extend a foot or so beyond the widest point of truck and plow. Their cab-top position keeps them out of flying snow and insures visibility at all times.

To eliminate, so far as possible, the accidents that occur when motorists refuse to recognize the danger of red lights and run into snow plows, we are trying out a new idea in warning signals. Across the front of the cab is a sign which says "P L O W" in letters 6½ inches high, made by a very penetrating neon light. The especially penetrating quality of this neon light makes the sign visible through the headlight glare, for a greater distance than ordinary red lights. The sign is of special construction, designed to withstand the vibration of the truck, operates from a 6-volt battery and uses but little current. This light is effective day or night and we believe this sign will stop many accidents caused by the inability of motorists to identify a snow plow during the daytime, to say nothing of the night. The signs are rather expensive, but, then, so are accidents, and the word "P L O W" across the top of the cab, we believe is the best thing yet devised to compel the attention of the motorists and prevent accidents that may be costly to the department in damage suits.

Each of our trucks also carries a spotlight which can be turned in any direction. The spotlight is invaluable when our drivers are aiding snowbound automobiles, as they are instructed to do at all times when plowing is not urgent enough to refuse them the time. Incidentally, when one of our drivers was nearly killed by carbon monoxide fumes from a leaky manifold heater, a few years ago, we installed hot-water heaters in all trucks.

### **City Not Liable for Street Superintendent Acting as Highway Surveyor**

The Massachusetts Supreme Court held, *Bradley vs. City of Marlboro*, 5 N. E. (2d.) 439, that a municipality would not be liable for negligence of its superintendent of streets in constructing a culvert which caused the flooding of adjacent property if the superintendent was acting as a highway surveyor even if there was a causal negligent connection between the superintendent's acts and the damage sustained. Under the Massachusetts statutes an engineer in charge of construction who on his own initiative constructed a culvert as part of a general drainage system for a city which had adopted the Plan B form of government was superintendent of streets, road commissioner and surveyor of highways, for whose acts in making a plan of the system, which included the premises owned or occupied by the plaintiffs, the city was not liable.

**Electrolysis, largely due to an electrically powered railway, had so deteriorated a steel pipe system that over half the water was lost underground. There are several unusual features in the reconstructed system.**

## Preventing Electrolysis of Three Forks' Distribution System

F. F. PALMER

Consulting Engineer, Forsyth, Montana.

**A**N interesting project this year was the study to determine the kind of pipe to use in replacing the water distribution system of the town of Three Forks, Gallatin County, Montana.

Three Forks is so named because it is situated on the alluvial river bottom where the three rivers, the Madison, Jefferson, and Gallatin, unite to form the Missouri river, and, as is the case with practically all alluvial river bottom lands in the Great Plains area, where rain fall is more or less scant, there is a concentration of alkali, with some spots having enough alkali to be generally known as "hot spots".

These "hot spots" may be permanently wet, or wet only during parts of the year, and alternate moist spots and dry spots, in the soil surrounding the pipe, form the anodes and cathodes of the giant sized galvanic battery of the earth in which the pipe is laid.

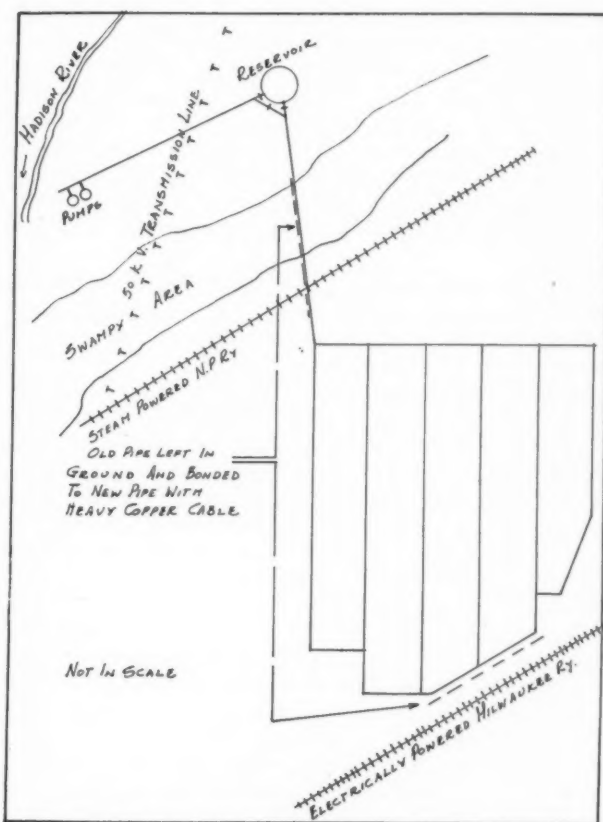
Corrosion of pipe is occasionally local because of some chemical in the soil being actively corrosive to the material of which the pipe is constructed, but in the Great Plains area corrosion apparently is due more to certain soil spots forming the anode for the galvanic soil current, with a consequent deterioration of the pipe where the current leaves the pipe.

Deterioration of pipe by reason of a difference in the metallic structure, while in the past a source of trouble in the Great Plains area, particularly with foreign-made pipe shipped to the West Coast as ballast in ships coming there for lumber cargos, is localized usually in small areas of a joint of pipe, and was clearly not the cause of the trouble. It was felt that modern methods of making cast iron pipe obviated any possibility of trouble from this source, and, the advantages of cast iron pipe over pipe of any other material for use in a water distribution system being so many, cast iron pipe was finally decided upon, Federal Specification WWP 421, horizontally cast pipe being used.

The problem at Three Forks was complicated by the fact that the electrified Milwaukee Railroad passes through the town, with a consequent inevitable stray current during the passage of electric locomotives. A further complication was the fact that Three Forks is in the so-called Helena "earthquake" area.

Through the courtesy of Montana Power Company, C. R. Davis, of their engineering department, made careful tests to determine the amount and direction of flow of both galvanic earth currents and stray D.C. current from the railroad.

It was determined that when an electric locomotive was in the yards, under power, there was a considerable flow of current—up to 25 volts—from the track to the



General plan of Three Forks distribution, railroad tracks, etc.

pipe, and that the amount of the stray current flowing to the pipe decreased, until the locomotive was about one mile distant from town, when the flow to the pipe reversed, and flowed from the pipe to the track. When the locomotive passed the sub-stations about 15 miles in either direction, flow of this current ceased. At all other times, there was a slight flow of current in the direction of the swamp, through which the pipe line from the reservoir to the distribution system is of necessity laid.

The Mayor and most of the Councilmen of the town are railroad men, working on the Milwaukee railroad, and an interesting point in this test was that these men could tell by the increase or decrease in the amount of current flow, that the engineer had shut off power to coast through a certain little town, or added power to pull up a point of additional grade, etc., and foretold within a few seconds, after becoming familiar with the



apparatus, just when the flow would increase or decrease, by their watches.

The pipe of which the original system was laid was a reclaimed steel pipe treated with a tar preparation, burlap wrapped and again treated with a tar preparation. This pipe had so deteriorated, due to failure of the protective coating, that only 35% of the water pumped was accounted for—and water services are 100% metered.

For most of the year, for the first few years after it was laid, this original pipe was in either moist soil or sand and gravel, or in water. Subsequent to the laying of the town-wide sanitary sewer system, however, at a depth almost universally below that of the water mains, the water table lowered, so that practically all of the water mains were above ground water except through the swamp, and even there the pipe, except for one spot, was above the water table in the winter months.

Consideration was given to three methods of protection: 1—Insulation by protective coatings; 2—Cathodic protection, by installing apparatus to apply direct current voltage to the pipe so that the potential of the pipe to the ground was maintained at a negative voltage; 3—Drainage, by offering no resistance or obstruction to any current, stray or galvanic, entering the pipe, and offering a ready means for these currents to leave the pipe in favorable locations through provided conductors.

Considerable research, study, and experimentation has been carried on by various pipe companies and by the Federal Government to ascertain the kind or kinds of pipe that best withstand the corrosive action of these hot spots, and of protective coating for pipe. Much progress has been made in the production of pipe coating, but as yet no positive cure-all coating has been developed, principally because of the impossibility of guarding against undiscovered damage to the coating by either carelessness or accidental injury in handling and laying. No amount of the most rigid supervision during construction can guard 100% against these causes of failure in protective coatings, regardless of how good the coating is, and the fact that the protective coating on the original pipe failed caused the city council to be suspicious of protective coatings.

Consideration of Cathodic protection determined that while this was probably the surest method, the initial investment would be considerable, and that operation, maintenance, and supervision costs would be incurred also.

Consideration was next given to protection by drainage, and a point in favor of this method was that all the galvanic earth current seemed to flow in the general direction of the swamp through which the line from the reservoir to the distribution system passed.

Protection by drainage appeared to be rendered easier by the fact that these water mains were being replaced; and while it was the intention to salvage the old pipe, sections of this old pipe could be left in the ground at selected locations, and a heavy copper bond installed from the new pipe to this old that had already established apparently perfect contacts for the discharge of currents, thus protecting the new pipe from pitting where the current was discharged from the new pipe to ground.

This last method was the method finally decided upon, and for this purpose approximately 3000 feet of the old 10" pipe was left in the ground through the swamp, and about 700' of the 6" pipe was left in the ground where the pipe paralleled the Milwaukee Railroad at the closest point, heavy copper wires being installed as

conductors between the new pipe system and these sections of the old pipe.

It is probable that the installation of a heavy copper cable at a depth of one foot or a little more, for a distance of about 2000 feet from each end of the old 6" pipe that was left in the ground paralleling the electrified railway, paralleling the track, and attached to the track at the outer ends, would have afforded additional protection, but this feature was decided against by the City Council, at least for the present, on account of cost.

The project was financed by means of a loan and grant from the Public Works Administration, and constructed by D. M. Manning, general contractor, of Hysham, Montana; the pipe being furnished by the Pacific States Cast Iron Pipe Co. It was designed and construction supervised by the writer, represented on the job by John F. Palmer.

## Chloramine Water Treatment Bibliography

A book of 226 pages entitled "Bibliography and Abstracts of the Chloramine Treatment of Water" has been published by the U. S. Works Progress Administration for New York City; the work having been under the direction of Lewis V. Carpenter, Director of Sanitary Engineering, New York University, with the Department of Sanitation of New York City as sponsor.

The basic material consists of data gradually compiled by Prof. Carpenter since 1930. Articles and papers, 242 in all, are listed, beginning with four by Sir Humphry Davy and others in 1813 and 1814, and 14 others during the 19th century; 48 appeared during the first quarter of this century, and the remainder during the years 1926-1937. In each case the name of the author, title of the article, and name of the periodical or society journal in which it appeared are given. Of most of the 131 appearing since 1930, abstracts are given varying in length from a short paragraph to five pages.

While the bibliography does not pretend to be complete, it should suffice to give those interested sufficient basis for a study of the development of the chlorine-ammonia treatment of water.

Prof. Carpenter informs us that he has a limited number of copies available for free distribution and could furnish them to a limited number of our readers. His address is New York University, University Heights, New York City.

## Magnetic Iron Oxide for Highway Center Stripes

C. D. Wells, construction engineer of The Texas State Highway Department, has announced a method whereby a permanent center stripe on highways is being built in the concrete, instead of painting one on with black pigment. Should it prove satisfactory and feasible, the old method of painting it on the concrete may be eliminated. By using magnetic iron oxide mixed with the concrete to a depth of one-fourth inch, a contrasting color is intermingled to produce a permanent separation of lanes.

Colors in red, orange and black have been perfected by the highway department. As yet, the red color has not been used, but orange on a background of black has proven highly beneficial in areas of poor visibility and fog, such as along the Texas coast. Lanes of a section of coast road are separated by an orange line parallel with, and adjacent to, two black lines.





## Permanent Street Signs for Pensacola

BY O. J. SEMMES JR.

City Engineer, Pensacola, Fla.

PENSACOLA, Fla., has long felt the need of permanent markers for street names. On two occasions during the past two years the names were painted on curbing of paved streets but this procedure has two drawbacks: the signs quickly become so dirty that it is difficult to see them, and there is no method of indicating the names at unpaved intersections.

The city in cooperation with WPA is now constructing permanent post markers of reinforced concrete. The markers are  $7\frac{1}{2}$ " x  $7\frac{1}{2}$ " x 6'-6" and are reinforced with four  $\frac{3}{8}$ " round deformed bars. The names are cast into the post with 3" reversed bronze letters, the names running vertically. The mix used is 1 part portland cement,  $2\frac{1}{2}$  parts coarse river sand, and  $2\frac{1}{2}$  parts pea gravel, with  $\frac{1}{10}$  part hydrated lime. The lime whitens the post and makes the concrete more workable around the letters. After the forms have been stripped, the surfaces are rubbed with a carborundum brick to remove the grain marks of the wood and to give a uniform texture to the concrete. After curing, the letters are painted with a flat black paint.

We have two sets of forms, each of which will cast six posts. The forms are so constructed, that no nailing is necessary in setting up a set of forms, the sides being held together with wooden clamps and braces. This makes for long life to the form lumber. The  $7\frac{1}{2}$ " dimension was adopted because it fits in perfectly with standard lumber dimensions. While one set of forms is being stripped from the posts and being cleaned up, the carpenter is setting up the other set. One set is poured each day.

The posts are buried  $2\frac{1}{2}$  feet in the ground and extended four feet above the ground line. They are placed in the grass plot right next to the sidewalk line on the north-west and south-east corners of every inter-

**These concrete post markers are being made by the city, using WPA labor, at a cost to the city of about \$1.36 each. They are being set at diagonally opposite corners of every street intersection, giving the street name on each of the four sides of the post, visible 100 yds. away at night.**

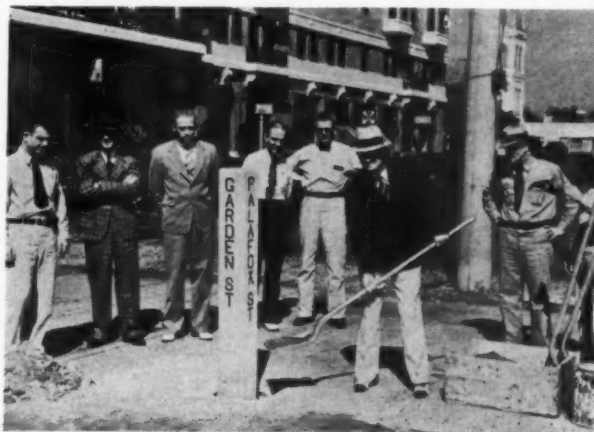
section in the city. After being set, a slab of concrete four inches thick and two feet square is poured around the base at the ground line. This both steadies the post and prevents high grass growing around it.

The project estimates for the making and setting of these posts is as follows:

Item	WPA	City	Total
Labor & supervision . . . . .	\$6,414	\$ 600	\$ 7,014
Materials . . . . .	1,150	1,060	2,210
Equipment . . . . .		1,050	1,050
Other costs . . . . .	100		100
Total cost . . . . .	\$7,464	\$2,710	\$10,374

The above estimate contemplates the making and setting of 2000 of these posts. This makes the cost to the city less than \$1.36 per post in place, or less than the support for the conventional type of marker.

The posts as finished are plainly visible at night for more than 100 yards and can be read at 100 feet. The



Setting the first post, Mayor Hagler doing the hard work

project is supervised by J.N. Jolly, Street Supt. for the city. Henry B. Foster is area supervisor for WPA. The writer is City Engineer for Pensacola and designed the posts.

### Chemical Dosage in Water Purification

Replying to a PUBLIC WORKS questionnaire concerning chemicals used in water purification, dosages of aluminum sulphate were reported from 55 cities. These dosages varied from 5 grains per gallon, which dosage was reported by two cities, to less than  $\frac{1}{2}$  grain per gallon, reported by three cities. Other dosages were as follows:  $3\frac{1}{2}$  gpg, reported by one city; 3 gpg by two cities;  $2\frac{1}{2}$  gpg by two cities; 2 gpg by eight cities;  $1\frac{3}{4}$  gpg by two cities;  $1\frac{1}{2}$  gpg by five cities;  $1\frac{1}{4}$  gpg by nine cities; 1 gpg by eleven cities;  $\frac{3}{4}$  gpg by ten cities.

Chlorine dosages were reported by a number of cities, but in some of these the exact dosage was not readily determinable, as the report was in pounds per day, or other indefinite figure. Of 65 cities giving exact dosages, results reported were: 1.4 ppm, four cities; 1.2 ppm, four cities; 1.0 ppm, five; 0.8 ppm, six; 0.7 ppm, two; 0.6 ppm, five; 0.5 ppm, ten; 0.4 ppm, six; 0.3 ppm, six; 0.25 ppm, four; 0.2 ppm, nine; 0.15 ppm, two; 0.1 ppm, two.

Lime dosages up to 15 grains per gallon were reported by a few cities, with the greater number of cities using lime reporting dosages around  $\frac{1}{2}$  gpg.

### Sewage Disposal Progress in California

REVIEWING the last ten years in matters of sewage collection and treatment in California, the Chief of the Bureau of Sanitary Engineering of that State states that it is apparent that the trends continue toward urbanization of the state and, with it, further approach toward universal sewer service. The number of incorporated places or sanitary districts has increased from 312 to 339. The percentage of urban population now served by public sewers is almost 94 and by treatment plants, nearly 58. The number of sewage treatment plants has increased nearly twice as fast as the incorporation of new places. There are now 237 treatment plants in 367 places having sewer systems. Population growth served by treatment works has just about kept pace with total population growth and with growth of population served by sewers, showing approximately a 30 per cent increase in the past ten years. This would seem to imply that California is just holding its own in sewage treatment. This is true in the larger cities. The smaller ones have forged far ahead and afford the most shining progress. Another ten years is certain to find the larger cities resorting to sewage treatment, where there is none at this time.

The trends have been quite distinctly toward the more common adoption of high grade or oxidation works, particularly in the form of trickling filters. Equally definite are the trends toward separate sludge digestion, the more common use of mechanized biologic processes, collection and burning of gases from sludge digestion, disinfection for odor control and for disinfection, more ornate arrangement and housing of sewage treatment works, somewhat less attention to the selection of treatment plant sites for better isolation, vastly greater realization of the value of operation and the operator, considerable increase in use of laboratory technique in plant control and various other trends perhaps not quite so noticeable. Probably the two outstanding developments of these ten years, which are

felt nearly everywhere, are the growth of the California Sewage Works Association and the spurt given sewage treatment as a result of the labor relief policies of the Federal Government in one form or another.

### Sewerage and Sewage Treatment in California, 1928 and 1938

	1928 Est.	1938 Est. (Jan. 1, 1938)
1. Total population in California.....	5,288,700	6,576,000
1a. No. of cities, towns and sanitary districts .....	312	339
2. Population—urban and sanitary districts .....	3,956,000	5,193,000
2a. No. of places served by sewers.....	325	367
3. Population served by sewers.....	3,820,000	4,853,000
3a. No. of treatment plants .....	182	237
4. Population actually served by treatment works .....	2,283,000	2,973,000
5. Per cent State population still needing sewage treatment .....	43%±	40%±

### James H. MacDonald Dies

James H. MacDonald, "Uncle Jim," the "Father of American Good Roads," died September 22d in New Haven, Conn., aged 87. He was one of the founders of the American Road Builders Association, was for many years its president and had served as treasurer since 1918. He was a member of the original 3-man highway commission of Connecticut created in 1895, and was the state's first highway commissioner, serving from 1897 to 1913.

His excellent work here and for highways generally has been recognized in numerous ways: A memorial plaque erected on Avon mountain commemorated him and the road he had built up it in 1913. In 1928, 25,000 attending the A. R. B. A. contributed a \$1,000 gift as token of their esteem. In 1933 he received the George S. Bartlett Memorial Award for his outstanding contributions to the science of road building. In 1934 he was elected to honorary membership in the Connecticut Society of Civil Engineers. Most prized of all by him, probably, was the host of friends which he had in the A. R. B. A., in Connecticut, and in the country at large.

### Chemical Industry Medal Awarded to Dr. J. V. N. Dorr

On November 4th the Society of Chemical Industry presented its "Chemical Industry Medal" to Dr. J. V. N. Dorr, president of the Dorr Co. This medal, awarded annually for valuable application of chemical research to industry, has been given this year to Dr. Dorr in recognition of his inventions and subsequent world-wide introduction of apparatus and processes in many chemical, metallurgical and sanitational operations which have made possible low cost production on a large scale. Dr. Dorr presented a paper entitled "The Influence of the Laws Relating to Research and Invention on Human Progress," in which he credited the American patent system with much of the material progress made by this country, although certain minor changes might improve it.

Dr. Dorr was born in Newark, N. J., in 1872; received from Rutgers University a B. Sc. degree and honorary degrees of Master of Engineering and Doctor of Science. He spent several summers in Thomas A. Edison's laboratories. For ten years following graduation he served several mining companies in different capacities, when he invented the Dorr classifier; followed by the Dorr thickener, agitator, and other equipment; and during more recent years by the well-known Dorr equipment used in the sewage treatment field.

# The Editor's Page

## The Fight Against Stream Pollution

An act of the recent Congress providing for a broad program of stream improvement was vetoed by the President on the grounds that the procedure provided in the act interfered with presidential control of the budget. The act vetoed was based on the present rivers and harbors procedure that has been used for many years by the War Department in its river and harbor improvement work, except that the Public Health Service was the controlling and coordinating factor in the work.

There is such a great need for a national program for the elimination of stream pollution that every interested agency—most especially the health and conservation interests—should organize to support this bill most strongly. We believe that arrangements have been made to reintroduce this bill at the coming sessions of Congress, with such changes as may be necessary to meet the objections which resulted in the veto of the original bill.

In January, 1935, PUBLIC WORKS in cooperation with leading authorities on this subject, laid down the basis for procedure, pointing out why a *national* policy was necessary in order to bear equally on all industries and all municipalities. It listed as four results of such a program: 1. Increase in employment; 2. Improvement in health conditions; 3. Gain in national wealth through the preservation of natural assets; and 4. Reduction in cost of purifying water for municipal and industrial uses.

## A Doctor Looks at Traffic Lights

A green light, says a doctor writing in the *Journal of the American Medical Association*, is an excitatory reflex prompting forward motion; but the red light is an inhibitory reflex calling for a stoppage of forward motion. These changes in traffic light colors often follow in quick succession (don't we all know it), and this quick succession of antagonistic conditioned reflexes and confusion in visual conditioning stimuli leads to what may be called an anxiety neurosis in miniature. This may result in quickening of the pulse, a pilo-motor response on the forearms, a dryness of the mouth, sudden excessive sweating of the palms, a feeling of epigastric distress, a sensation of inward tremulousness and even an observable tremor of the extended hands.

The answer to all this seems to be to find a signal less exhausting to the nervous system. As usual, it is up to the engineers. Traffic signal circles might help out, and are suggested.

## The Four Horsemen of the Highways

A few years ago, a popular book reminded us of the four horsemen of the Apocalypse; today, fatalities on our highways run into figures that dwarf ancient wars and almost equal the deaths from pestilence and starvation, as recorded in the past.

A writer for the Westinghouse Co. has called *darkness* the fourth horseman of the highway. What are the other horsemen of death that ride our highways? Speed, unsafe cars, narrow and twisting roads?

It seems to us that perhaps these might be used to emphasize in a dramatic way the death and disaster toll on our highways. We should like to have our readers tell us what they think the four horsemen on death on highways are. Popular education is needed to reduce highway accidents just as much as better highways and sound traffic control are needed. Anything that will appeal to the general public and aid in bringing home to them that safe and sane driving is necessary will help in reducing accidents.

## A Deferred Danger of the New England Storm

To reduce the danger of forest fires due to the millions of trees blown down by the big storm in New England's forests, it is proposed to haul them into streams and ponds; presumably to be sawed up later. This introduces a problem for water works men where these streams and ponds drain into their supplies, for not only may tastes be imparted by the wood, but there is danger of contamination by the hundreds of men and horses engaged in the work. The danger is probably greatest in relation to summer camps, cottages and hotels, but is by no means negligible in municipal supplies.

Given an extensive storage of this nature in a comparatively small body of water or in a small stream, there can be no doubt as to a tendency to quality impairment resulting, through more or less increased color and turbidity and a certain degree of "woody" taste imparted. Some resinous matter will exude from these green logs, most of which, however, would remain on the surface or be carried to the shores.

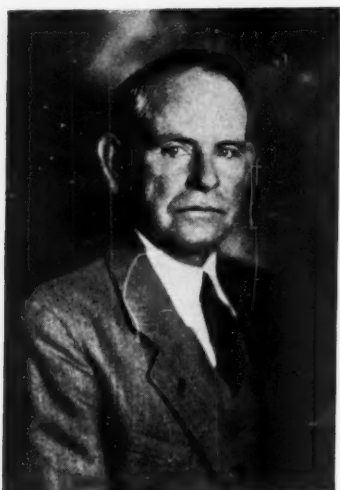
The potentially dangerous contamination can be met by chlorination, but its possibility should be recognized. It would seem advisable for state health boards to keep informed on what is being done on the water sheds of their states and see that proper precautions are taken by all affected thereby.

## CHRISTMAS SEALS



**Help to Protect Your Home from Tuberculosis**





# Building a Circular

By S. P. MATTHEWS  
City Engineer, Ardmore, Okla.

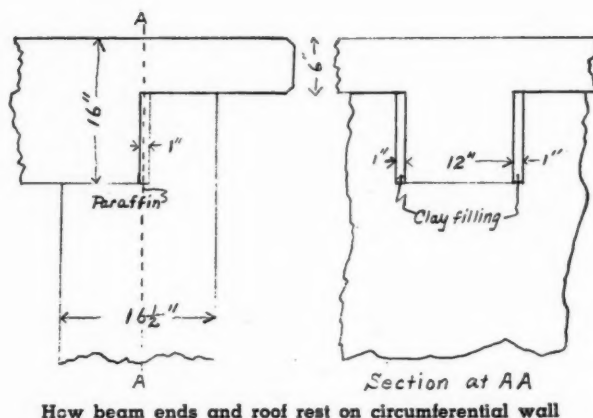
IN JUNE 1936 the city of Ardmore, Oklahoma, placed in service a new water treatment plant consisting of rapid sand filters and flocculation and sedimentation basins with a capacity of 3 mgd, with 267,000 gal. of clear water storage. During the summer and early fall of that year it became apparent that this storage capacity was too small and its complete exhaustion would be threatened by peak consumption. While this critical condition did not occur that year, during the summer and early fall of 1937 there were occasions when it was seriously threatened.

In view of this and to provide for normal growth of consumption, the city engineer recommended that additional storage at least  $1\frac{1}{4}$  times the existing capacity be provided; and he was instructed by the city manager and commissioners to prepare plans and estimates for at least 350,000 gal. additional storage.

Room for expansion on the site of the treatment and pumping plants was so limited that it seemed desirable to economize the available space as much as possible in designing the new clear well; also that it be placed adjacent to the existing clear well and connected to it with adequate conduits to afford free passage of water between them. These requirements seemed to be met best by a rectilinear structure with a storage depth of 11 ft. 3 in. and a floor area of about 54 x 80 ft., its south wall built in contact with the north wall of the existing basin.

Such a basin was designed using reinforced concrete, with beams at top and bottom of the exterior walls, into which all stresses were resolved, the beams being reinforced at intervals by tie struts across the structure; but this plan was discarded because no satisfactory means could be devised for safely resisting stresses set up at corner junctions due to temperature changes and temperature differentials between exposed and covered parts. Accommodation to these changes seemed best attained by employing the cantilever type of wall, where footing and wall structure act as a unit, any longitudinal segment is independently stable against overturn, and expansion and contraction are provided for and leakage prevented by dividing the wall into sections connected by crimped metal strips. The cost of such a basin was estimated to be \$13,800, including all accessories. The roof was designed to float on columns and walls, except for column ties at the most centrally located columns, and estimated for a live load of 70 lb. per sq. ft. The  $f$  was taken as 16,000 lbs. for steel and 650 lbs. for concrete, and  $n$  as 15, with maximum toe base pressure of 1 ton per sq. ft.

On February 24th bids were received, the lowest responsible one being \$11,354, exclusive of accessories



such as piping, gates, etc. which the city had on hand. Prior to that date application had been filed for WPA assistance, which was granted in March, but with provisos, the principal one being that we submit a different plan requiring less massive construction; and all bids were therefore rejected. The only alternate design seemed to be a circular structure, and this could not be made to produce a compact plant or to economize the space for future expansion. However, as the participation of PWA would save the city considerable money (estimated at probably \$6,000), we changed the design to a circular tank with 75 ft. inside diameter, the north-west portion of which extended over a lake for a maximum distance of about 10 ft. This was approved by WPA and was built, all unskilled labor being furnished by them (except in certain instances when continuous casting of floor, roof and walls required additional forces furnished by the city), a part of the semi-skilled, a superintendent and timekeeper, and the portland cement. The city furnished the balance of the materials, a superintendent of construction, all skilled labor and some semi-skilled, engineering and laboratory service, and transportation of all materials.

In designing the walls of the tank, the tension stress on the circumferential reinforcing steel was limited to 10,000 lb., to keep at a minimum the extension of the steel when placed in tension by the filling of the tank. The footings, wall and floor, though cast separately, were so reinforced that they could be considered a monolith. A water stop consisting of a strip of 16 oz. copper connected the base of the wall to the floor at the joint between the two to prevent leakage there. The roof is supported by 21 12 x 12 in. columns and by the outside wall on which it is free to move under temperature

# la Concrete Clear Well

**This clearwell, 75 feet diameter, was built to act as a monolith, except that the roof is free to move on the top of the wall—which involved some unusual construction methods. The bottom overhung a lake by ten feet, necessitating a special foundation.**

changes; the roof slab being 6 in. thick, supported by 10 x 12 in. beams which rest upon the columns. The roof was designed for a live load of 65 lb. per sq. ft. The same unit stresses for concrete and steel as in the first design were used for floor, footings, column and roof; but for the walls, 10,000 lbs. was used for the steel and 850 lbs. for the concrete. Concrete for the walls was mixed 1:1.66:3.33 to obtain an ultimate crushing strength of 3,500 lb. at 28 days; that for the rest of the structure was mixed 1:2:4 to give 2,500 lb. in 28 days.

The ends of the beams sit in recesses in the top of the wall, a 1" space being left between the sides of the recess and the sides and end of the beam to allow the latter to move under temperature. The engineer experienced some difficulty in devising means for forming the spaces in pouring the concrete, but accomplished it by means of tin plates braced in position in the recess, the 1" space between the beam-end plate and the wall being filled with melted paraffin and those at the sides with stiff clay. When the concrete had set, the clay was raked out and the paraffin was melted with a hot iron probe and flowed out. All concrete was kept moist and protected from the sun by means of wet canvas and burlap, wet backfill, and ponding on the roof until the structure was filled.

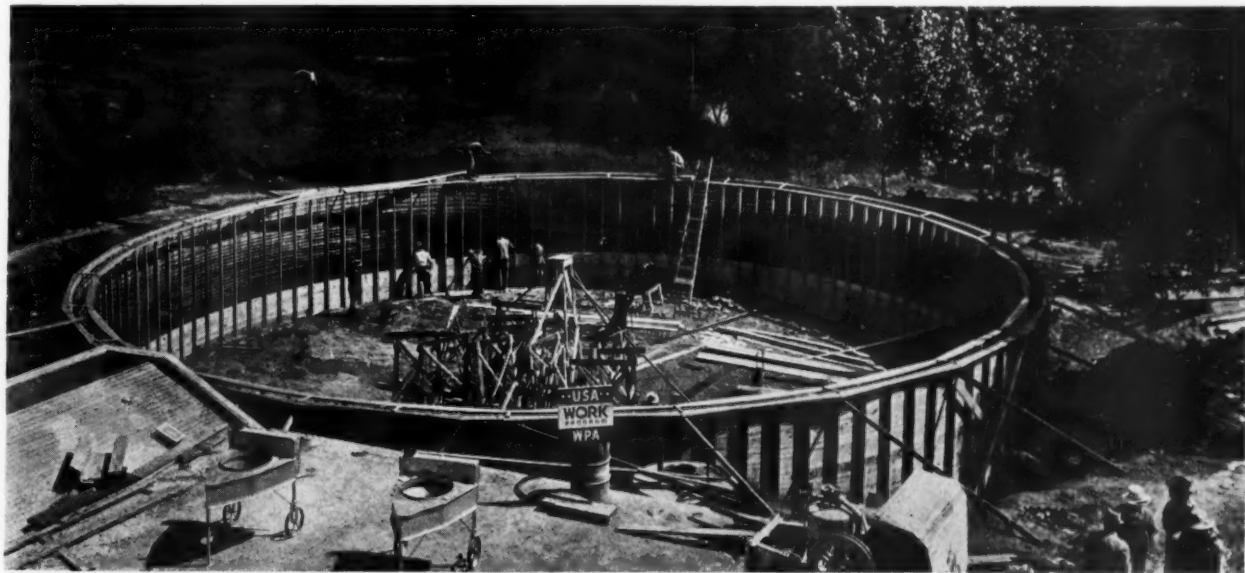
All excavation was done by man power. Where the structure extended into the lake and the adjoining area

the excavation would have to be carried 6 ft. below footing grade to obtain a soil with bearing capacity equal to that under the rest of the structure, and we elected to carry the wall footing on piers and beams for a distance of about 50 ft. around the circumference of the structure.

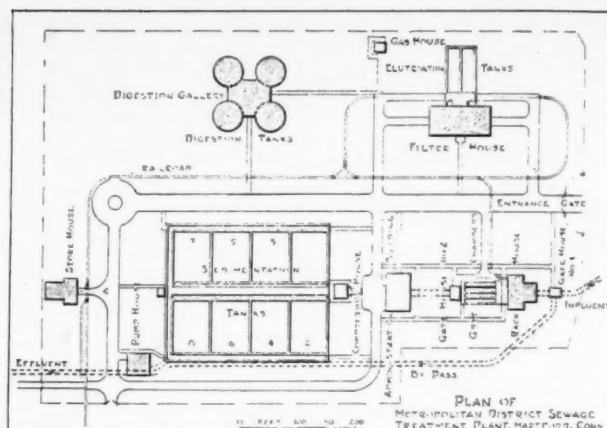
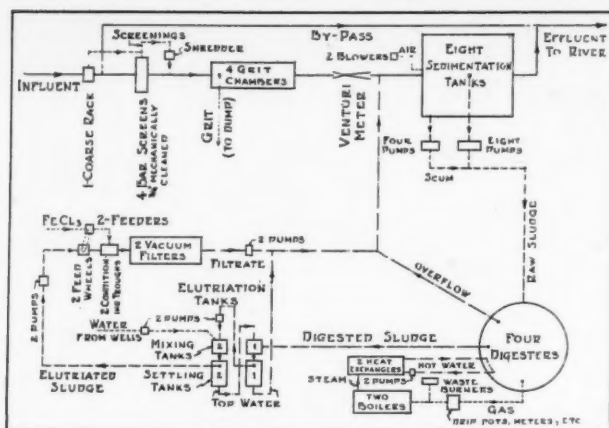
Ground was broken May 14th, the footings cast June 17th, and the roof forms were stripped August 25th. Next day the clear well was filled and all conduits closed. After 6 hrs. the height of the water was observed, and 24 hrs. later no fall in the water level could be detected and the structure was put in service. To date no cracks or other defects are visible in any part of the structure.

The cost of the structure to the city was about \$8,160. The engineer's estimate of the total cost was \$13,150, based on the following quantities: 1:2:4 concrete, 231 cu. yd.; 1:1.66:3.33 concrete, 106 cu. yd.; 24.33 tons reinforcing steel; 403.5 lb. structural steel; 161 lb. sheet copper; 26.7 tons cast iron pipe and fittings; 6 gates; 1,473 lbs. pig lead; 141 lbs. of oakum; 0.09 ton asphaltic cement; 945 cu. yd. excavation and 570 cu. yd. of backfill.

To City Manager V. R. Short is due a large part of the credit for the success of the project. The WPA superintendent was Sam M. Moore. The construction superintendent representing the city was Elmer Linthicum. The author was the engineer in charge.



Footings and floor slab cast, wall steel in place, forms under construction



Flow diagram and plan of sewage treatment plant, Metropolitan District, Hartford, Conn.

## Hartford Metropolitan District Sewage Treatment

THE Sewage Treatment Plant of the Hartford, Conn., Metropolitan District has been in operation for several months, and figures of the operation from June to September are now available.

This plant treats the sewage of Hartford, West Hartford, and parts of Wethersfield, Bloomfield, Windsor and Newington, Conn. The combined population served is about 200,000, estimated to increase to 300,000 by 1955. The amount of sewage provided for is an average of 25 mgd, with a maximum of 80 mgd. The sewage is treated by sedimentation, except that when the flow of the river rises above the 8 ft. level it is bypassed around the plant, it being impossible to maintain gravity flow to and through the plant at such times. The usual height of the river in summer is 3.0 or less (6,000 cfs), with a minimum summer height of 2.0 (5,000 cfs). During June to September the plant was operating 80% of the time, with an average flow of 17.2 mgd.

The sewage passes first through a coarse screen of 1" bars with 4" clear opening, hand cleaned; then through a set of four screens of 1/2" bars with 3/4" clear opening, mechanically raked, two of which are used at average flow, three at maximum flow, and one held in reserve; the water depth through the screens varying from 3.3 to 5.5 ft. All screenings are passed through a shredder and returned to the sewage, which then goes to the grit chambers.

There are four grit chambers, each 8'4" wide by 60' long, with a maximum water depth of 5'. They are designed to operate with sewage velocities not exceeding 1.2 sec. ft. nor less than 0.7. Each chamber has two lines of endless chain scraper-conveyors and a screw elevator-washer, which discharge the grit into industrial railroad cars, which convey it to a dump. Two of the grit chambers are used at average flow, three during maximum flow, and one held in reserve.

The sewage then passes through a 72 x 36 in. venturi meter of 100 mgd capacity, with indicating, integrating and recording attachments, to the sedimentation tanks. There are eight of these, each 68 ft. wide, 100 ft. long and 9 ft. deep. With all tanks in operation, they give 3 hr. detention at the 1938 average rate, 2.2 hrs. at the 1950 average rate, and 1.1 hrs. detention at the plant

capacity of 125 cfs. Each tank contains four longitudinal and one cross collector-conveyors, for collecting sludge and scum. The sewage is aerated in the influent channels as it enters the tanks. The effluent from the tanks flows over weirs about 60 ft. long to the river outlet.

Eight sludge pumps and 4 scum pumps pump the solids to four digestion tanks each 50 ft. diameter by 30 ft. deep, with conical hopper bottoms and a domed roof arranged for gas collection, and heating coils. There is no scum submergence, stirring or other mechanism in the tanks.

The digested sludge is drawn into elutriation tanks, two units of a mixing tank and settling tank each. The settling tanks are each 85 ft. long by 23 ft. 5 in. wide, with two mechanical collectors per tank. Water for elutriating is obtained from wells.

The elutriated sludge is pumped to two vacuum filters, being first conditioned with ferric chloride. Each of the vacuum filters has a filtering area of 350 sq. ft. The filtrate and top water from the elutriation tanks, together with the digestion tank overflow, are returned to the sedimentation tanks.

During the months of June-September, there were removed from each million gallons of the sewage, 2.6 cu. ft. of screenings, 11.2 cu. ft. of grit, 3,168.8 gal. of sludge of 96.5% moisture, and 42.9 gal. of scum.

The reduction of B.O.D. averaged 40% and removal or suspended solids 75.1%.

In the digestion tanks the 96.5% moisture of the raw sludge was reduced to 84%, and the solids were reduced 50% by volume, 70% by volatile matter. Elutriation changed the moisture content to 87.3%; and this was reduced to 55.1% in the sludge cake.

The gas produced reached a maximum of 229,750 cu. ft. per day, or 0.54 cu. ft. per capita, of which only 12.1% was used. This gas had a B.t.u. value of 590 per cu. ft., analyzing 65% methane, 30% CO<sub>2</sub> and 2 1/2% H<sub>2</sub>.

The wash water used average 257.2 gal. per million gallons of sewage; the air, 0.055 cu. ft. per gal. of sewage. The average rate of dose of ferric chloride was 1.63% of the dry solids. No lime was used. The vacuum filters averaged 6.7 lbs. per sq. ft. per hr.



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Tractor-drawn plow widening after truck plow.

## St. Croix County Licks Old Man Winter

By H. B. OLSEN

County Highway Commissioner, St. Croix Co., Wisconsin

WHEN I think of the number of complaints I receive every winter about the amount of snow on this or that road in the county, I nearly come to the conclusion that I know very little about plowing snow; however, I shall attempt to explain a few of the methods we use in keeping about 1,400 miles of County, State, and town roads open every year. As we approach this subject, we have to start, not with snow plowing, but with drift prevention, which is the most economical way to keep roads open. Money spent for the raising of subgrades and the building of wide ditch sections is the best possible investment for permanent drift prevention.

Snow fence is, and always will be, a very necessary part of drift prevention, and they should be erected wherever required. The proper erection of snow fence requires a great deal of time and study. We have, in some instances, put fence on both sides of the roads and have occasionally erected two lines of fence on one side of the road. Whenever there is a doubt in our minds as to whether we need fence on a new grading job, trying it without fence settles the question.

Although high subgrades, wide ditches and snow fence all help to reduce the number of drifts, we still have them and still need plowing equipment. The most important item for efficient snow removal is good equipment and plenty of it; good operators and good shop men are also imperative. Good equipment will not stay good very long, plowing snow, without proper care; and to give it the proper care, you must have a good, warm shop and good, conscientious men—men who can be depended upon to keep everything in number one condition ready to go at all times. This work can be done much cheaper in the shop than out on the job.

In our county, the shops are centrally located, and all the equipment operates from there. We believe that it is good economy to have the patrol superintendent go over the roads after each storm when possible to determine what type of plow is needed to do the job; so that we don't send out bigger plows than are necessary but the plows which will to the job as efficiently and as economically as possible. This man as well as the operators are instructed to call the office from designated points. The information they give is valuable in

**St. Croix truck-plows operate 16 hrs. a day, spends 8 hrs. in the shop for servicing. Large tractor plows work 24 hrs. a day until all roads are widened. If ice forms, and icy pavements are a serious problem, it is broken up with discs and scraped off.**

**UNTREATED GRITS**  
An inefficient way to skidproof icy pavements. Grits lie on top of ice until blown off, kicked off by traffic, or imbedded in ice by pressure of passing vehicles. Heavy, slow applications necessary.

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to skidproof icy pavements... Cut time, materials, cost

**I**CE control with calcium chloride is simplified ice control!

Stock piles can be prepared anytime, left without care or attention through the coldest weather—only the heaviest rains affect them. When emergency comes, treated grits will be loose, unfrozen, ready to be spread over dangerous icy surfaces.

Fast melting action of calcium chloride imbeds each treated grit in ice in a matter of minutes. Wind has no chance to blow it away; traffic can't throw it off. Calcium chloride treated grits form an abrasive, safe surface at once—and it's there to stay until the emergency is past!

With each particle of skidproofing material made effective by calcium chloride, the amount of material necessary to insure the safe flow of traffic is greatly reduced. One truckload of treated grits goes sev-

eral times as far as the same amount of untreated abrasives. And because calcium chloride allows a thinner spread, trucks travel faster, cover many more miles per hour.

Actually, it costs no more to do the better job of ice control—with calcium chloride treated grits. Savings in time, materials, and grief more than make up the difference in cost per ton.

Highway engineers from coast to coast have proven the calcium chloride method of ice control. It's the one speedy, positive, economical way to skidproof pavements in any temperature from 32° to 60° below!

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What Wisconsin snow plows have to contend with

giving up-to-the-minute road information, which I believe should be available to the travelling public at all times. The plowing of our roads is done in the order of their importance—first the State and Federal highways, then the county roads, and lastly the town roads.

Much has been and much can be said regarding the time to start plowing, and how to plow; but I believe that this can be best determined by the man in charge of the work. In our county, we start plowing just as soon as in our opinion it is necessary to keep traffic moving. We then send out our heavy four wheel driven truck plows to keep the traffic going. The drivers are instructed to plow through the heavy side first, thus putting the snow to both sides of the road more evenly. We have two drivers on each truck who change off driving, and they work in 14 or 16 hour shifts; they then bring the truck into the shop where it is serviced while they sleep. I believe it is more efficient to do this than to leave the truck on the job for a greater length of time, because that is more expensive and wastes more time if the plows break down out on the job. We keep up this routine until we have all of our roads open. We also use small tractor plows for this purpose, especially on town roads and roads which are not constructed too well. We use them as sparingly as possible, however, because they are very little better than trucks and are less economical to operate.

Soon after the trucks go out, our large caterpillar tractor plows follow over the same routes and push the snow out over the shoulder or as far off the road as possible, which is very important. If the snow is kept as far to the side as possible, the roads will very seldom be blocked to such an extent that they can not be opened by truck plows. We believe that this is, in the long run, much more economical than just opening the road with a truck plow, and we do not consider a road really plowed unless the snow is as far to the side as possible. We use one-way blade plows to clean up after the tractor plows. We also use heavy one-way plows mounted on trucks for widening, especially early in the season, as they do a good job until the banks are four or five feet high, and they are much cheaper to operate than tractor plows. We keep our tractor plows on the job 24 hours a day until all the roads are widened; the drivers work in two shifts with two drivers in each shift.

During long-continued storms, when it is almost impossible to keep traffic moving, we keep right on plowing, sometimes accomplishing nothing towards keeping the roads open, but we have helped many a stalled car or truck and have saved several human lives, and this alone, we believe, justifies the extra effort and expense. As an added safety measure, we have installed large colored headlights on all of our equipments. This distinguishes them from ordinary trucks; we believe this is important, because snow plows are very

hard to see after dark, and cars are apt to collide with them unless warned of their presence in this manner. This equipment is standard in the state of Minnesota.

On all of our important paved highways, we believe that all of the snow should be removed at all times. Even a light snow which does not bother traffic will compact and form an icy and dangerous condition which may necessitate later removal at a much greater expense. We plow as close to the pavement as we can with the plows and take the rest of the snow off with power patrol graders. We take all the snow off so that the pavement is bare, and we do it as quickly as we can, because heavy traffic soon turns snow to ice, which is much harder and much more expensive to remove.

It has been my experience during sleet storms that a disc is very helpful; even if it does not cut the ice off entirely, it leaves a rough enough surface to prevent uncontrolled skidding of automobiles, as is common during sleet storms. After the ice is broken up by the disc, we take it off the pavement with power patrols much as we do snow, with one important exception. We use a half-size blade, i.e. on a 14-foot moldboard grader we use a 7-foot blade; this puts enough weight on the blade to cut the ice. Icy pavement is undoubtedly the worst thing that we have to contend with because it is so dangerous and hard to remedy. In the fall of the year we mix sand with calcium chloride and place it in small piles all along the highway, especially on all hills and curves, which by all means should be sanded whenever necessary. We do this work night or day, whenever needed, as we are close to the twin cities and have a great number of heavily loaded trucks on our highways which cannot get up the hills if they are not sanded and present a very dangerous traffic hazard if they are left stalled on the highway.

Keeping the crews lined up, getting the relief crews out and back, keeping the equipment going and ready, seeing that all plowing charges are correct, trying to satisfy the towns and other governmental units who are interested in keeping their roads open, and all of the other things that are included in good, efficient and economical snow removal, help keep us fellows busy, and it is pretty hard to stay within WPA working hours.

Good snow removal demands the best of all our efforts. To comply with the service expected of us for efficient snow removal and for the safety of the travelling public, with an ever watchful eye on the taxpayer's money is our aim; and to achieve our goal we must build and maintain good organization of good dependable men, we must keep and maintain the best and most efficient equipment, and be on the job ready to go at all times night or day.

### Distinction Between Subcontractor and Materialman

Where a gravel company agreed to furnish the materials for the construction of a sewage treatment plant in accordance with plans and specifications prepared by the engineers and to make deliveries in accordance with the instructions of the contractor's representative on the job, the gravel company was a subcontractor and not merely a materialman, and one to whom the gravel company in turn gave a contract to supply materials and labor necessary in the construction could recover as a materialman from the surety on a bond requiring payment of indebtedness of subcontractors for materials and labor furnished in connection with the work, the Michigan Supreme Court holds (*People for use of Young v. U. S. Fidelity & Guaranty Co.*, 249 N. W. 20).

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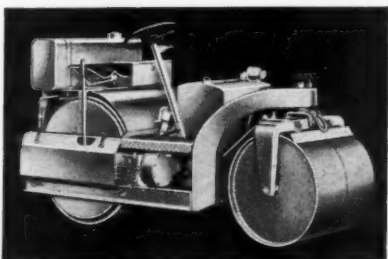


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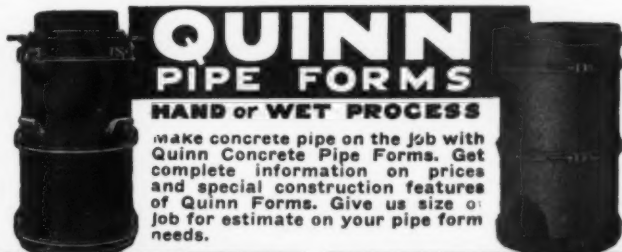
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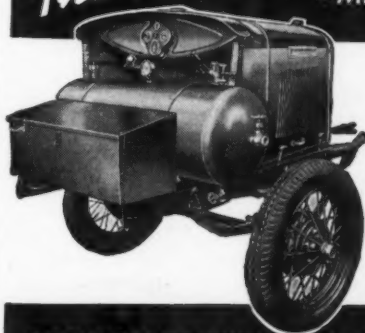
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## DESIGNING A GRIT REMOVAL PLANT

(Continued from page 11)

and multiplying the result by the subsiding velocities (in feet per second) given in Table I.

**Table II**  
Detention Period in Terms of Time Required for One Particle to Settle From Top to Bottom

Tank Area Sq. Ft.	$\frac{a}{t} = \frac{bv}{e}$ (300 M.G.D. 60° F)							
	Particle Size—mm.							
	1.00	0.80	0.60	0.50	0.40	0.30	0.20	0.15
2500	2.06	1.71	1.30	1.09	0.87	0.66	0.43	0.31
5000	4.12	3.42	2.60	2.18	1.74	1.32	0.86	0.62
7500	6.18	5.13	3.90	3.27	2.61	1.98	1.29	0.93
10000	8.24	6.84	5.20	4.36	3.48	2.64	1.72	1.24

As previously pointed out, under "ideal" basin conditions all figures greater than 1.00 indicate 100 per cent removal and figures less than 1.00 are the removal proportion for that size, assuming the entering quantity to be unity. On the basis of one hundred percent removal when  $\frac{a}{t} = 1.5$ , all figures greater than 1.5 indicate one hundred percent removal and figures less than 1.5 indicate partial removal in the ratio of the  $\frac{a}{t}$  value to 1.5. Comparative basin efficiencies computed by this method, as well as the "one basin continuous" method, are shown by curves on Figure 1.

The next step was the designation of size to be removed. Reports on the mechanical analyses of sewage grit are meager and inconclusive. No uniformity of size of distribution is indicated. Figures reported by Metcalf and Eddy indicate that approximately seventy percent of sewage grit will be retained on a No. 60 screen (U. S. Standard 0.25 mm. opening). A symposium on grit chamber practice (Trans. A.S.C.E. 1927) reported the desirability of removing all particles over 0.2 to 0.3 mm. in size. For the Baltimore tanks, it was thought that if reasonably high percentages of 0.25 mm. size could be removed, basin performance would be satisfactory. Figure 1 shows that all particles 0.25 mm. and larger will be removed on the  $\frac{a}{t} = 1.5$  relationship when the basin area = 7,500 square feet. On the basis of one basin continuous relation, sixty percent of this size will be removed. It is probable that actual removals will fall somewhere between these values.

These curves led to the adoption of a tank area of 7,500 square feet. Various tank combinations and arrangements, all of approximately 7,500 square feet total surface area and suitable for the installation of standard grit removal equipment, were then studied. Depths were selected so as to provide reasonable detention periods with horizontal velocities varying from 0.50 to 1.0 foot per second.

It was realized that basin performance computed by this method would be modified in practice by various basin disturbances which were not considered in the calculations. Nevertheless, it is believed that this approach to the problem gives a reasonable basis for the comparison of tank performance and a means for determining the size of units. A theoretical method is of definite value when research and experimental studies in advance of construction are not feasible.

### Construction Details

Three 50 x 50 ft. tanks were decided upon, each capable of treating 100 mgd at maximum capacity. At this flow the depth will be approximately 6 ft., the theoretical detention period 100 seconds, and the average horizontal velocity 0.5 ft. per second. At the

influent gate chamber the flow into any or all of the tanks is controlled by structural steel sluice gates approximately 7 ft. square. The gates are operated by electrically driven rack and pinion hoists located on a platform 7.5 ft. above the top of the tanks. The effluent gates are similar in size, type and method of operation. Any tank or combination of tanks may be used. It is expected that not more than two tanks will be in service during normal flows, the third tank being maintained as a spare for peak conditions. Covered influent channels 8 ft. 6 in. wide carry the sewage from the gates to the tank proper. The influent side of each tank has five ports, each 9 ft. in clear width and provided with four adjustable steel deflector plates which move in a plane parallel to normal tank flow and are manually adjustable to project into the influent channels varying distances up to 2 ft. The function of these deflector plates is to control and direct the flow evenly across the tank cross section. The effluent is discharged over adjustable submerged weirs on the side opposite the influent.

The collecting mechanisms in the tanks move the settled material outward and discharge it through an opening in the tank wall into a channel 3 ft. wide and sloping up on a 1:4 grade, up which it is hauled by the removing and cleaning mechanism and discharged onto a belt conveyor, common to all three tanks, which transports it to the control building, where a bucket elevator lifts it into trucks or a storage bin. The conveyor and the elevator are capable of handling twenty-four tons of one hundred pound per cubic foot material per hour, the conveyor speed being seventy-five feet per minute and the elevator speed two hundred feet per minute. This capacity is approximately double the estimated maximum grit load, but it was discovered that standard conveying equipment as currently manufactured provided these capacities as a minimum, and that equipment designed especially for the expected loads would be more expensive and impractical. It is estimated for Baltimore that the maximum amount of grit recovered will be approximately twenty cubic feet per million gallons. This is based on figures reported from various cities which indicate loads from three to twenty cubic feet per million gallons. For a flow of 300 mgd, 20 cubic feet per mg is 250 cubic feet per hour or twelve tons per hour of 100-pound per cubic foot material. Four tons per hour per tank means 1.37 cubic feet per minute, and at nine strokes per minute, the cleaning mechanism rake must discharge only 0.15 cubic foot per stroke. The manufacturers guarantee capacities well in excess of thirty cubic feet per mg.

A central panel board in the grit building controls the operation of the grit removal mechanisms, the conveying equipment and the elevating equipment. Push button control stations are also located at the machines. No remote control is provided for sluice gates.

The construction cost of the completed structures will be approximately \$147,000 exclusive of engineering, supervision and general municipal overheads. This figure is equivalent to approximately five hundred dollars per million gallons of total capacity.

### Painting Hartford Fire Hydrants

Some of the 3,231 fire hydrants in service in Hartford, Conn., were given a new paint treatment last year as a trial. First all the old paint was burned off. Then they were given a priming coat, and finally a coat of Duco. The Water Bureau hopes that hydrants thus painted will retain their freshly painted appearance for more than the usual three-year period between paintings.



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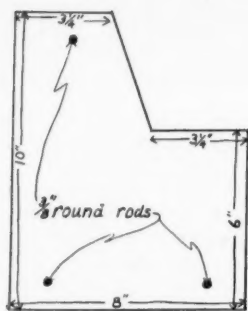
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*Boiler Furnace Lining Costs Are Lower With*

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Cross-section of curb

# A New Curb Design for Low-Cost Paving

BY ARTHUR E. J. JOHNSON

City Engineer, Water Commissioner and Clerk

**A**BOUT the first of August, 1938, Red Oak, Ia., finished a WPA waterworks project and began on a street improvement project under WPA calling for curbing with a modified gutter and paving with clay-bound gravel with an inverted penetration bituminous wearing surface.

As this project was being considered, the question of a curb for a low-cost pavement received considerable attention. Heretofore, the standard curb and gutter has required a considerable amount of concrete material. We have several types in our city, from the old straight curb to the reinforced curb and gutter sections, all varying in length from 7' to 40' in section.

The remaining unimproved streets of our city are mostly in front of property that cannot stand an assessment cost for high grade paving and curbing, and the problem of cheaper curbing was put squarely in the lap of the engineering department to solve. The city engineer drew a plan of curb with a very narrow section, figuring that if he could make a curb only wide enough to use as a grade line for the completed paving and still having enough stiffness, he would have what most cities and towns could use on streets where a full paving program was not justified because the property could not stand an assessment. This section is 10" deep on the vertical back, 8" wide on the bottom, 6" high to the gutter, which is 3 1/4" wide, above which rises the curb 4" higher with its face sloping 1 1/2", giving a top width of 3 1/4". In this section are placed three 3/8" round steel rods, one near the top and one near each bottom corner. The section has the general shape of a standard angle iron, which is one of the hardest sections to bend or put out of shape for the amount of material contained in it. The engineer figured that there was no reason why reinforced concrete could not be put to about the same use as steel, and the gutter section was designed along this line.

The city engineer, because of this design, received very much criticism and a little abuse from some of the people who are interested in concrete material, but others, appreciating the fact that there was merit in the design, believed enough in the ability of the engineer to give him a chance to build it. The amount of concrete material required is only about one-fourth that of the standard section, and, naturally, a reduction of 75% would make many people wonder as to the safety of this section.

We have built about 3,000 ft. of this section as a beginning of a project that may reach five miles before it is complete. With a section as small as this, the cost

**A city engineer designs a concrete curb that contains only a fourth as much concrete as the standard section and costs proportionately less. Has been used with low-cost paving and stood some hard traffic knocks without any injury. Cost is assessed on property owners, who file requests for it faster than city can build it.**

in many localities will be so low that even the streets where 25% of the lots are vacant can become improved streets without any serious objection or damage to the property owner.

We are in a locality where all of our concrete material must be shipped

in, and therefore, the material costs run higher than they do in many other localities. Even with this handicap, we are furnishing a finished street at a cost of \$25 for each 45 ft. frontage. This includes curbing with this modified gutter and paving with a gravel base, clay-bound, and a bituminous surface composed of primer coat, two binder courses, and a seal coat using crushed limestone passing a 1/2 inch screen and retained on a 3/16" screen as a minimum aggregate for the wearing surface.

To date, we have finished over 1200 ft. of this improvement. Although the weather has been very unfavorable, the curb has stood shocks and tests far beyond what it was calculated to receive without showing the least sign of failure or damage. The curb has been run over by auto when it was only one and one-half days old, shortly after the forms were taken off, with no filling on either side of the material as it will be when finished; farm wagons have backed into it; it has been struck with graders; all with no apparent effect on its strength or stability, as in no case did even a fine crack develop.

The costs of this project will be borne by an assessment of \$25 for each 45 ft. abutting property, and the project is being carried forward only where 100% of

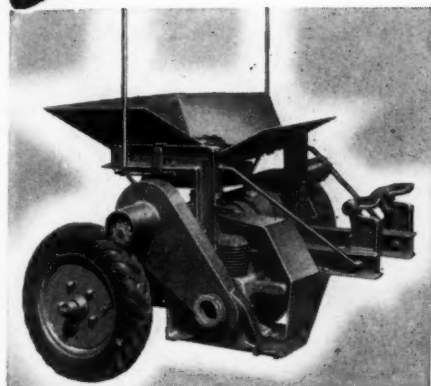


A line of completed low-cost curb

# Three

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### For high speed or heavy material

The Model MM transmission type, equipped with independent motor, affords a disc speed that will spread evenly up to a truck speed of thirty miles per hour.



### For sanding icy roadways, seal coating or spreading dust laying material

The Model M transmission type, without motor, will spread from six to thirty foot widths at a speed of five to thirty miles per hour.



### For spreading agricultural lime or fertilizer, also for moderate road use

The Model H regular type will economically spread the desired material to widths desired, at speeds up to five miles per hour.

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GASOLINE OR DIESEL POWERED

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*are favorably known for  
their advanced design—  
always one or two years  
ahead.*



The entire thoughts and attention of the Frink Organization have been devoted to the constant improvement and careful manufacture of this one product, for the past seventeen years—not just during the winter months.

*It is not surprising, therefore, that Frink Sno-Plows have won recognition as "the last word" in snow removal equipment.*

You will want to investigate and keep posted on the new and exclusive features of the complete line of Frink "V" Type and One-Way Type Sno-Plows.

*So why not write for your  
copy of Catalog 38AP to-  
day?*

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the property owners on the street asked for it; they signing a waiver waiving all the legal procedure necessary for a special assessment. Every day as the work progresses, new signers are filing at the city office and signers for three times as much work as we now have under construction are already filed 100%, and it looks like we are going to have to ask for an extension of the project that we planned when it started.

There is no question but what, if W.P.A. is to continue (and I believe it will continue for some time), special assessment must be employed as the means of procuring funds for the part furnished by the city, as very few cities have amassed enough surplus during the past few years to take care of the additional funds required to complete a W.P.A. project going continuously.

We are one of the eight cities in the United States between 5,000 and 10,000 population that are out of debt, and by doing things in a sane and sensible manner, we feel that we can continue to keep from paying a high interest rate and still do our part towards W.P.A.

### Effect of Natural Cement in Concrete Pavements

Within the last few years considerable scaling of concrete pavements has resulted from the use of chemical salts in ice treatment in the Northern States. In an effort to combat this condition the New York State highway department began, about 4 years ago, to experiment with a blend of portland and natural cement for concrete pavement construction.

Preliminary tests made in the laboratory of the New York Department of Public Works indicated that concretes containing blends of portland and natural cements had greater resistance to alternate freezing and thawing in a solution of calcium chloride than had concretes containing only portland cement. These preliminary laboratory experiments were followed by the construction of a number of experimental sections of actual pavements, using portland cements of various chemical compositions and two natural cements, both made in New York State and both readily available commercially.

The Bureau of Public Roads became interested in this work and carried the studies further to determine the effect on strength, volume change, absorption, density, etc. Tests were made of both laboratory specimens and cores from road pavements. From these it was concluded that replacing a portion of the portland cement with natural cement reduced the crushing and flexural strength slightly when 14 to 28 per cent of the portland cement was so replaced, but the resistance of the pavement surface to alternate freezing and thawing was increased materially by use of one of two natural cements used in the test but less so by use of the other.

### Damages in Condemnation Proceedings

The Constitution and statutes of Kentucky impose liability upon a county for land taken for road purposes; but that liability is limited to damages actually sustained by the owner. An owner's damages from the taking of land for state highway purposes was limited by the Kentucky Court of Appeals, in a condemnation proceeding, to the fair market value of the land actually taken and of a small adjoining strip rendered useless by the construction of the road. (*Leslie County vs. Davidson*, 270 Ky. 705, 110 S.W. (2d.) 652.)

# ON THE SKYLINE DRIVE



## WITH GALION TANDEM ROLLERS . . .

Four of these tandem rollers are being used by the J. R. Ford Company for resurfacing work on the Skyline Drive in Virginia. By following one another in staggered formation as shown, these truly modern rollers can compact a lot of material in an eight-hour day.

Equipped with a dependable and economical 6-cylinder engine, either gasoline or diesel, the Galion tandem roller has ample power and weight (variable 8 to 12 tons) for any job of new construction work, and on resurfacing, rebuilding and widening of old roads.

High grade materials, fine workmanship, balanced design and the liberal use of anti-friction bearings insure durability, long life and dependable performance. Records of operating and service expenses show splendid economy not only on this particular job (illustrated) but on all jobs where the tandem is being used.

Catalog No. 220 fully describes and illustrates the details of construction and operation of this variable weight tandem roller. Let us send you a copy.

Rollers: 3-wheel, tandem, portable and trench

Motor Graders: Master diesel, standard and Junior Patrol

Pull type graders: Various types and sizes, manual or hydraulic control

Spreaders: for stone, sand, gravel, asphalt

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Baker Snow Plow on Allis-Chalmers Tractor Used by Bannock County, Idaho, near Pocatello

# BAKER

## SNOW PLOWS

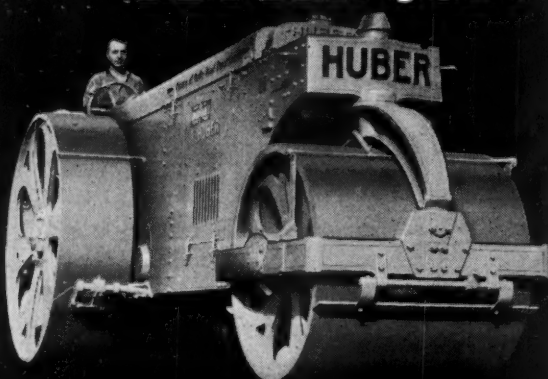
Only with a Baker Snow Plow was Bannock County, Idaho, able to open up its blocked roads. Hundreds of counties and cities in 36 states depend on Bakers to keep their roads open.

The many models and types of snow plows built by Baker for both trucks and tractors offer you the widest selection for your particular requirements.

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Built to do a ...  
**BETTER JOB!**



Sturdy construction combined with many modern and exclusive features of design account for Huber's lower operating costs—lower maintenance—plus the extra speed which enables it to do a better job in less time. Huber Road Rollers invite comparison. Buy by comparison—and you will buy a Huber. Write for Bulletins describing these modern machines in detail.

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Sizes from  
5 to 12 Tons  
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## County Road Surfacing Program for Gravel Roads

A program for improving the gravel roads of King County, Wash., was initiated in 1937 by the county engineer, H. H. Sisler, using a 3-stage light bituminous surface treatment.

The first stage of construction consists of blading the existing surface to a uniform section by means of a heavy road grader, equipped with a scarifier when necessary. Then all loose surface materials are bladed into windrows along each edge of the road, and the surface swept free of dust and dirt. The application of SC-2 oil is then made with a pressure distributor at the rate of about 0.5 gallon per square yard. Immediately following this, the material in the windrows is bladed over the freshly treated surface, and broomed until the bituminous cement is sufficiently set to prevent raveling under traffic, after which it is compacted with a power roller.

In this manner about 80 miles of road, roughly half of which was in each of the two road districts into which the county is divided, were put through the first stage of construction in 1937. These stood up well through the winter months.

The second stage of construction consists of patching and leveling the first course, placing a light shot of oil for a tack coat; then a layer of  $\frac{3}{4}$ -inch minus crushed stone aggregate over the surface. This is given an application of MC-2 asphalt, using about 0.3 gal. per sq. yd., bladed to an even surface, and rolled to insure uniformity.

The third stage consists of patching and leveling the two previous courses and applying a state standard non-skid seal coat, using RC-4 asphalt and crushed stone aggregate,  $\frac{3}{4}$  to  $\frac{1}{4}$ -inch, and  $\frac{1}{4}$ -inch to dust. The surface is then rolled to insure proper compaction of the seal coat.

The cost of this 3-stage construction varies somewhat with the local conditions, but averages throughout the county about \$1800 per mile. It is expected that, by the end of 1938, 155 miles of gravel surface will have been treated in this manner.

## Road Construction Workmen's Compensation Cases

The Georgia Court of Appeals held (in *Liberty Mut. Ins. Co. v. Mangham*, 193 S. E. 87) that injuries to an employee of a road construction contractor while riding to the site of his work in the truck of a gravel hauling subcontractor, by arrangement with his employer, was compensable under the Workmen's Compensation Act as "arising out of and in the course of his employment," although the employee's pay did not begin until he reached the location of his work.

A quarry employee was killed during operations in which the quarry was furnishing stone to a highway contractor who had agreed to carry all insurance required for employees of the quarry, which did not carry workmen's compensation insurance. The contract involved the use of WPA funds. The Virginia Supreme Court of Appeals held (*G. G. Waugh & Co. v. Mollison*, 192 S. E. 694) that the quarry owner was a subcontractor of the highway contractor and not an independent contractor, and that deceased widow was entitled to compensation, where the highway contractor immediately after the accident reported to the insurance company, admitting that the deceased was its employee.



## Regenerating Zeolite Water Softeners

In the article "The Operation of Water Treatment Plants" which appeared in the April, 1938, issue of *Public Works* appears the statement: "The rock salt for regenerating the zeolite is made into a brine," etc. H. M. Olson, of the Ohio Salt Co., writes us that this might lead readers to think that only rock salt can be used for this purpose, and calls attention to the fact that KD evaporated salt is used for the purpose, even though the cost may be 50 to 75 cents a ton higher, which is more than offset by the sand, shale, etc., contained in rock salt but not in good grades of evaporated salt. Of 55 municipal softeners in Mr. Olson's trading area, 52 use KD evaporated salt.

Specifications issued by the Permutit Co. and approved by practically all the zeolite manufacturers call for a fineness between 8-mesh and 50-mesh for rock salt, "but evaporated salts may have 15% through a 60-mesh screen." It must contain not less than 98% sodium chloride, have a phenolphthalein alkalinity of zero, and no grease, fat or oil content. It should dissolve completely in 15 min. in the standard float experiment. Most evaporated salt runs 99.3% pure Na Cl.

Mr. Olson makes some other suggestions. After regeneration, the effluent should show not over 17 to 40 ppm hardness, as indicated by the fact that not over 10 to 15 drops of B & B soap solution are required to make a permanent lather. As a check test on actual hardness, take a 40 cc sample of the water and add sufficient B & B soap to make a permanent lather that will stay up 3 minutes; then (assuming that 20 drops equals 1 cc), from the total number of drops subtract 5, divide by 4.5, and the quotient will be the grains of actual hardness.


Another suggestion is that of the proper time for rinsing the salt solution out of the zeolite bed. For greensand having an exchange value of approximately 3,000 gr. per cu. ft., rinse at about 2 gal. per sq. ft. per min. for 20 to 25 min. For high-capacity greensand, at a 1.5 gal. rate for approximately 30 to 35 min. For good grades of synthetic zeolites with 8,000 to 10,000 grains capacity, use a low rate so as to rinse the beds in 55 to 65 minutes.

## Floating Roof for Standpipe

Carrington, N. D., has a standpipe 18 ft. diameter and 72 ft. high. Apparently it gets cold there in winter, for, up to five years ago, a cylinder of ice formed on the inside of the tank every winter, and, when a spring sun heated the steel tank, broke loose and floated up against the roof of the standpipe and tore it loose. After repairing and replacing the roof several times they substituted a floating roof. This rests on the top of the standpipe, with 8 vertical legs outside it to hold the roof in place as it rises and falls—which it does every year but without giving any trouble.

## To Users of the Water Works Manual

On page 38 of the 1938 edition of our Manual of Water Works Equipment and Materials, speaking of coatings for steel pipe, we speak of "Biturine," made by the General Paint Corporation, as a combination of coal tar pitch with Trinidad Lake asphalt. The manufacturers inform us that they have not used asphalt in this material for four years, and that, as now made, Biturine enamel is an all-coal tar pitch enamel used in mill coating and wrapping with multiple coat application.



**HOW Pensacola, Fla.**  
**GOT MORE WATER FOR**  
**\$3,000 A YEAR LESS COST**

U. S. NAVY PHOTO—  
Courtesy Pensacola Municipal Adv. Board

**OLD WELLS** and out of date pumping equipment could not produce an adequate supply of water. Power cost was excessive. The City of Pensacola was growing rapidly. Mains were being extended. Something had to be done.



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Layne engineers surveyed the situation. Their recommendations were accepted. The Layne-Central Company (one of the Layne & Bowler, Inc., affiliates) installed and equipped a 26 inch well that gave Pensacola 3,600,000 gallons of water per day. Power cost alone, saved over \$3,000.00 a year. Another 26 inch Layne Well was installed to give them a 100 per cent "standby" supply of water. Thus they are not only saving money, but are getting more and better water. Both wells are gravel wall, underreamed type and concrete sealed from strainer to ground level against seepage and unwanted intermediate water strata.

Wherever you go, you will find Layne Wells and Pumps giving complete satisfaction to cities and industries of all sizes. For literature that fully explains their many fine features address LAYNE & BOWLER, INC., Dept. W, Memphis, Tenn.

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*PRICE per foot installed* is an uncertain index of the eventual cost of an underground main which is intended as a permanent installation. The real yardstick is the *cost per service year*. With a useful life of more than 100 years—with maintenance cost either nil or negligible—cast iron pipe is by far the lowest-cost material on a service year basis. This is a matter of record.

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# U.S. CAST IRON PIPE

When you need special information—consult the *classified* READER'S SERVICE DEPT., pages 55-57



### Housing Topeka's Sewage Plant

To reduce odor nuisance, Topeka, Kans., enclosed its bar screen, detritor, preaeration unit and primary clarifiers in a brick building. During the winter wall and roof condensation produced an almost continuous rain and the building is filled with a dense fog and all metal work is corroded. Odors outside the building are greatly lessened, but conditions for the operators inside are highly objectionable. Possibly this is due to the high temperature of Topeka's sewage—70°-72° during the winter and reaching 87° in August, which is due to the high temperature of the packing house wastes.<sup>636</sup>

### Sludge Treatment At Topeka, Kans.

Returning waste activated sludge to primary clarifiers increases the B.O.D. and solid content of the effluent going to the activated sludge tank, increasing the load on it and lowering its efficiency, increases operating cost, may cause bulking. To avoid this, Topeka uses a thickener, which treats mixed liquor from aeration tanks, waste activated sludge from final clarifiers and supernatant from digesters. In the digesters, trouble with undigesting scum was overcome by installing three turbomixers, each with three impellers, near the bottom, middle and top of the tank, respectively. There is 3-stage digestion, first 20 days in the primary digester, accompanied by more or less violent agitation; the second, in two tanks, with very gentle stirring; the third, with no stirring, in a tank which contains a floating gas holder, to which gas from the other three tanks is brought. Capacity of the gas holder, 40,000 cu. ft. under 4 oz. pressure.<sup>637</sup>

### Chlorination And Sewage Bacteria

Sedimentation of unchlorinated strong sewage at 10°C which effected 40% removal of suspended solids reduced the chlorine demand by only 3%, and though the total bacterial count was reduced 34%, the number of coliaerogenes (gas formers) present practically doubled. When chlorinated, a 15-min. contact period is sufficient to satisfy completely the chlorine demand of the sewage. A residual chlorine content of 0.1 ppm at 15 min. kills approximately 99% of the bacteria in either settled or unsettled sewage; less than 15 min. produces correspondingly lower satisfaction of chlorine demand, and the bacterial kill lags behind the per cent

satisfaction of demand; and if contact be continued to 30 or 40 min. there is practically no increase in chlorine demand. When prechlorinated settled sewage is added to a large volume of untreated lake water, relatively no regrowth of sewage bacteria is observed.<sup>638</sup>

### Pipe Color Scheme In a Treatment Plant

The pipe galleries of the Austin, Tex., 12 mgd treatment plant, ranging from 300 to 600 ft. long, contain numerous lines of 6" to 30" cast iron pipe. To enable the plant operators to identify these at a glance, air pipe lines are painted silver; pipes carrying raw or partially treated sewage, brown; red pipes connect final clarifiers with digesters; yellow pipes carry return sludge; drain pipes are painted blue.<sup>72</sup>

### Designing Grit Chambers

Grit removal chambers and equipment were designed for Baltimore's Back River treatment works, to handle 300 mgd of sewage; the design being based on the sedimentation theory, guided by the principle that sufficient surface area should be provided to allow satisfactory settling of all grit particles more than 0.25 mm in size. Use was made of established relationships between particle size, subsiding velocity and proportion of removal. Detention periods were taken 50% longer than would be required for 100% removal under ideal conditions. These assumptions and calculations gave a required area of 7,500 sq. ft. (three 50 x 50 ft. square tanks) and a depth of approximately 6 ft. Removing and washing mechanism is provided.<sup>83</sup>

### Treating Milk Wastes

An experimental plant consisted of a 1,600 gal. primary tank, two 25 ft. percolating filters and two 1,600 gal. final tanks. Effluent from the primary tank was diluted with purified effluent, distributed to one filter with a rotary distributor, settled, the effluent filtered through the second filter, and settled. More than 99% purification was achieved; the effluent had a B.O.D. of 7 ppm. Clogging of the filters was avoided by reversing their order of sequence. Activated sludge treatment gave a final effluent B.O.D. of 20 ppm. A milk factory stores its wastes for a few hours, with controlled temperature and aeration, during which fermenta-

tion occurs, and separation of the fat and casein, and after sedimentation the effluent is passed through percolating filters; more than 99% B.O.D. reduction is obtained.<sup>754</sup>

### Painting at Sewage Plants

Paints used around sewage works have to combat unusually severe conditions and must be permanently waterproof, acid- and alkali-proof, and resistant to H<sub>2</sub>S. For concrete there should be 3 coats, the primer penetrating the pores. Under water, refined reinforced coal-tar paints are adequate. Above water, if black is objectionable, only synthetic enamels should be used. For interior and submerged steel surfaces, reinforced coal-tar is satisfactory if the sewage gas is not too strong; but if the gas is strong or if exposed to sunlight, neither coal-tar nor asphalt paints are satisfactory, and synthetic resin enamels should be used. To test the value of a paint for sewage works, apply 2 coats of the clear base paint to 3 glass plates. Seven days later put a few drops of 40% sulphuric acid on one plate, of 10% hydrochloric acid on another plate, and of 5% sodium hydroxide on the third, and cover with watch crystals. If, after 10 days, there is no sign of peeling, blistering or other disintegration, the paint is satisfactory.

Surfaces painted must be dry, free from grease and dust; if smooth concrete, this should be etched before painting. Concrete should be washed and wire brushed; if any grease remains, scrub with a solution of 1.5 oz. of trisodium phosphate and 1.5 oz. of soap chips in a gallon of water, rinse and dry. All surfaces must be thoroughly dry; inside buildings it may be necessary to keep a fire burning during painting.<sup>126</sup>

### Making Tight Sewer Joints

Making tight sewer pipe joints in wet ground is most successful when the trenches are dewatered by well points, giving a dry trench for working and inspecting the pipe, reducing the amount of sheeting needed, and eliminating need for concrete encasement, cast iron sewer or other special construction. For making tight joints, bituminous compounds are outstanding, both hot poured and preformed. The author uses 1" depth of oakum packing, about 1½" of hot poured bitumen, and an outside cement mortar fillet wrapped in a muslin cloth tied tightly in place. Using these joints, he laid 19 miles of sewer with a total infiltration of 3,790 gpd or less than 3 gpm. His specifica-

tions limit infiltration to 5,000 gpd per mile for 8" pipe, 7,500 gpd for 12" pipe, 9,500 for 15". Working in quick-sand, infiltration seldom exceeds 25% of the limit.<sup>x2</sup>

**Bibliography of Sewerage Literature.**  
The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; n, note or short article; p, paper before a society (complete or abstract); t, technical article.

**D The Surveyor**  
September 16

54. p. Disposal of Milk Wastes and Milk By-Products. By D. Davis. P. 316.

September 23  
55. c. Invert Construction in Drainage System Chambers. By L. A. Taylor. Pp. 335-336.

56. Sewage Disposal at Sheffield. Pp. 345-346.

October 7  
57. Constant-Velocity Detritus Channels. By L. B. Escritt. Pp. 383-384.

**E Engineering News-Record**

- October 6  
28. Suggestions on Sludge Pumping. P. 445.

October 27  
29. Alloy Steels in Sewage Disposal Plants. Pp. 524-527.

**G Water Works & Sewerage**  
October

36. Design and Operation of the Topeka Activated Sludge Plant. By T. R. Haseltine. Pp. 971-977.

37. Reduction of Bacteria in Sewage by Chlorination. By G. E. Symons, R. W. Simpson and W. L. Toney. Pp. 983-989.

38. Venturi Metering Equipment in Mod-

ern Sewage Works. By R. T. Regester. Pp. 990-992.

**H Municipal Sanitation**  
October

57. A Decade of Sewage Treatment: 1928-1938. By C. G. Hyde. Pp. 480-484.

58. Dependable Sewer Maintenance. By L. M. Johnson. Pp. 491-494.

**J American City**  
October

25. New Primary Sewage Plant at Middletown, Conn. Pp. 37-39.

26. Protection of Concrete and Steel in Sewage Treatment Plants. By A. F. Pistor. Pp. 44-46.

**L Civil Engineering**  
October

9. The Detroit Sewage Treatment Plant. By C. W. Hubbell. Pp. 667-669.

**P Public Works**  
October

39. A Year's Experience With Chemical Precipitation. By J. W. Hood. Pp. 13-15.

40. Safety in Maintaining Sewers and Sewage Treatment Plants. By L. W. van Kleeck. Pp. 21-22.

41. n. Inventory of Sewage Disposal in California. P. 49.

**X Proceedings, Maryland-Delaware**  
Water & Sewerage Ass'n  
Year of 1938

1. The Stream Pollution Problem. By A. Wolman. Pp. 1-4.

2. c. Construction Methods to Prevent Infiltration in Pipe Sewers. By W. A. Goff. Pp. 27-32.

3. Design of Grit Chambers for Back River Sewage Works. By A. R. Vollmer. Pp. 62-76.

4. Control of Mine Drainage Stream Pollution in Maryland. By G. L. Hall. Pp. 83-95.

5. Recent Sewage Treatment Practice. By W. A. Darby, A. L. Genter, and W. Donaldson. Pp. 105-127.

**Y Pipe Progress**  
October

2. Austin, Tex., Completes New Sewage Plant. Pp. 11-14.

## Incinerator Not a Nuisance

The Michigan Supreme Court (Somers v. Detroit, 284 Mich. 67, 278 N. W. 767) after reviewing cases in its own court and in other jurisdictions holding certain activities to be or not to be nuisances which may be enjoined, held that an incinerator of modern design and ample capacity, if properly constructed, will not create a nuisance or be detrimental to the health, well being or property values of the residents of the vicinity.

## Syracuse Sewerage

It is expected that the end of this year will see the completion of a \$3,000,000 WPA project for sewers and sewage treatment at Syracuse, N. Y. This is the Ley Creek sanitary sewer system and treatment plant, for which the Federal expenditure will total about \$2,500,000 and that of the city \$500,000. There are 375 men now employed on the work. In its early stages it employed a total of 2,000.

## Use PFT Equipment in Your Sewage Treatment Plant

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*Forrest Nicholas*

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"Before we used these machines, it was quite an expensive job and very slow work. By using these machines we can clean sewers for about 3c a foot. Prior to that it cost about 19c a foot." From an interview in the Lake County Globe-Ledger, Feb. 4, 1938.

• • •

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# The Waterworks Digest

**Abstracts of the main features of all important articles dealing with waterworks and water purification that appeared in the previous month's periodicals.**

## Special Rates For Sprinkling

LITTLE ROCK, Ark., with a water supply four times its present consumption (65 gpd per cap.), encourages use of it for lawns, flower gardens, etc., to beautify the city, by low summer rates; during June to October, all water used in excess of last June consumption is charged half the regular rate. Spartanburg, S. C., tried (in 1935 and 1936) allowing each consumer to use in summer an amount in excess of his average winter month usage at a reduced rate, but abandoned it as unjust, cumbersome and creating ill will. "The simplest and safest type of special summer rate is a flat percentage reduction on all water sales during the sprinkling months.... Generally speaking, separate services, meters, and piping systems for sprinkling water are economically unsound and do not contribute to permanent good will toward the utility."<sup>A119</sup>

## Baffles in Settling Basins

At the Montebello (Baltimore, Md.) filters, subsidence was improved by a submerged cross baffle with a horizontal wooden apron on its top extending 3½ or 4 ft. up stream, the apron built in the form of a parabola, so that silt-laden water would not rise over the top of the baffle. If water enters a basin at the bottom, a baffle should be placed near the entrance to prevent bottom scour, built on a slope or with a top apron extending horizontally a distance sufficient to secure a positive horizontal movement of the water at the surface.<sup>X4</sup>

## Determining Water Main Sizes

In designing the extensions to the distribution system of Highland Park, Tex., the sizes of mains were determined by calculating, for each main, that size which gave the lowest combined annual cost of owning and pumping; the former being cost of main in place amortized for a life of 100 years (cast iron), the latter being the estimated cost of pumping the quantities which it was assumed the main would have to carry.

About two miles of pipe which had

been used previously in Dallas and vicinity, some since 1911, was salvaged and used by Highland Park, being taken up, cleaned and recoated with hot tar.<sup>Y2</sup>

## Construction of Floor of English Reservoir

A 4,000,000 gal. reservoir recently built at Nuneaton, England, 215 x 251 ft. with vertical walls and concrete slab roof, has a floor built in two layers, each laid as 18 x 12 ft. panels. The lower layer, 4" thick, is of 1:6 concrete, the upper one, which is 3.5" thick of richer mix and was not laid until the roof had been completed, was laid with ½" open grooves between slabs, which were later grouted, in two operations, with 1:1 sand-cement grout, except that in the joints along the base of the wall the second grouting was replaced by an insertion into the groove of 1" of elastic bitumastic material. The roof was made in 18 x 12 ft. panels, with joints over the supporting beams, with sheet lead inserted across the joint and a V groove in the top of the joint filled with an adhesive elastic material.<sup>D31</sup>

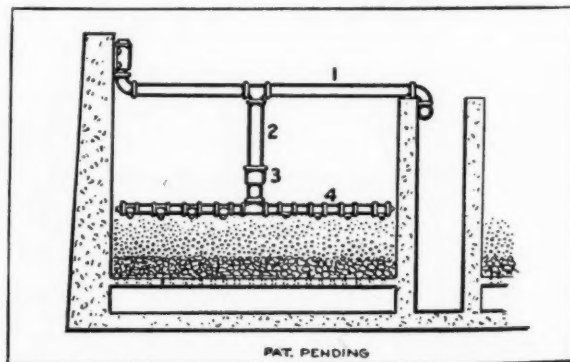
## Rubber Pipe For Water Mains

Rubber pipe has been used in several cases for carrying both water and sewage, and the author believes it has "definite possibilities, both as to first cost and permanency, provided its use be confined to those surroundings to which it is inherently adapted." It should not be used on rocky or other abrasive material, where the rubber might be cut, bruised or otherwise damaged, nor in water heavily polluted with agents aggressive to rubber. At Eastport, Md., 150 ft. of 8" pipe carried a water supply across a channel. The main tube was 6-ply reinforced with a helix of 0.283 in steel wire, covered with heavy fabric and this with a coating of ¼ in. tough tread rubber; the tube being lined with pure crepe

rubber especially compounded to avoid taste and odor (this was considered important). After 8 years' use it was approximately in as good condition as when laid. The cost was \$2,000 less than that of iron pipe laid on a pile and timber foundation. In 1937 350 ft. of 3" rubber pipe was laid in 14 ft. of water to carry water under 90 lb. pressure. Two installations of 8" pipe as sewer outlets are described. All four were laid in soft bottom.<sup>X2</sup>

## Filter Washing

If filter sand is kept clean, rates of 3 or 4 gal. per sq.ft. would be practicable. Cleaning a filter requires breaking up the turbid matter collected in it. High washing rates may not do this, and if it is done otherwise, a 25% expansion will suffice instead of 50% and a cleaner filter result. Agitation for breaking up this matter may be by air wash, but preferable is the Baylis surface wash, Jewell sub-surface wash or the Palmer agitator. Although a filter be overloaded, with a poor type of bottom, improperly shaped troughs, too great freeboard, and low washwater velocity, it can be washed clean if agitation is used. The author prefers no troughs, but spilling wash water over sides and ends of filter. Troughs, if used, should be V-shaped, level top and bottom, and as short as possible. The freeboard is usually too great; unless the top of the expanded sand comes to within 2 or 3 in. of the edge of the trough during washing, the larger particles of dirt will not be washed out but will settle back to form mud balls.<sup>X4</sup>



Water Works & Sewerage  
Sketch of Palmer self-propelling "Filter Sweep"



# Recent Catastrophes

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Floods in the Ohio and Mississippi Valleys  
Windstorms and Sleet  
Are not confined to any locality

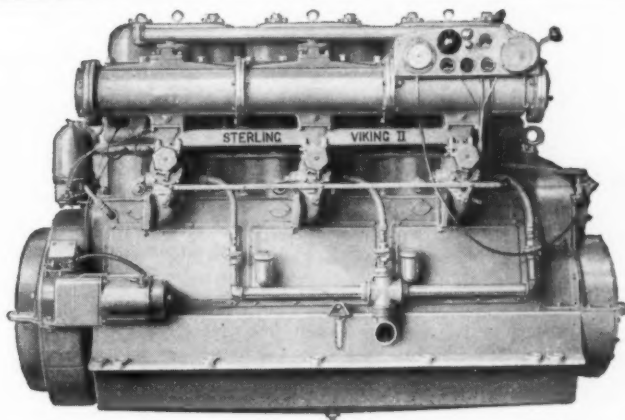
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Laying Pipe at Bogota, Colombia

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## LOCK JOINT Reinforced Concrete PRESSURE PIPE

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Pressure : Sewer : Culvert : Subaqueous

The filter sweep designed by C. E. Palmer, engineer of the Erie, Pa., water department, consists of a horizontal pipe (4) equipped with slanting nozzles which revolves about a bearing (3) on the end of pipe (2), which is suspended from pipe (1), which serves as both supply pipe and support. Pipe (4) is revolved by the reaction of the jets, the water being under a head of 80 to 100 lb. It is placed about  $\frac{1}{2}$  in. above the filter sand. When the filter is ready for washing, the agitator is run for 3 or 4 minutes, then the backwash is started and run just enough to make the sand so fluid that the agitator can make 5 or 6 revolutions a minute. Use of this reduced wash water 25 to 40% and made dirty filters clean.<sup>E38</sup>

#### Clearing Land For Reservoirs

To estimate cost of clearing land for reservoir sites, it is necessary to know the acreage of timber and brush, classified as (a) heavy timber, (b) brush and widely scattered trees and (c) generally clear. Timber costs \$50 to \$100 per acre, or more; brush about \$10. First cut and burn brush and trees less than 3 in. diameter, then fell the large timbers and cut into 12 ft. lengths. Disposal of the timber is the troublesome problem. It may be burned or converted

into firewood or lumber. In burning, it may be piled first and then burned, or the fire started and timber piled on as it burns. The former is safer, the latter burns it more completely and gives less clean-up work. Burning is most effective when a brisk wind blows lengthwise of the pile. Clearing is an intangible task attractive to entirely inexperienced bidders.<sup>E45</sup>

#### Iron Lining Strengthens Conduit

In Toledo, O., a plain concrete conduit 72" diameter, walls 10" thick, is the only connection between filtration plant and distribution system. Much of it is below hydraulic gradient, the pressure being resisted by the load of the earth above, generally 20 ft. deep. In changing the grade of a highway above it the cover was reduced to 8 ft., where the hydraulic pressure in the conduit was 12 lb. per sq. in., producing a stress of 35 lb. per sq. in. on the concrete. To resist this pressure, 500 ft. of the tunnel was lined with steel plates, 10 ft. long, one-quarter the circumference in width, No. 8 gauge, giving 66" inside diameter, the space between plates and concrete being grouted by air pressure. The plates were placed from a mid-length shaft, joints bolted, the nuts being spot-welded on the out-

side of the joints. The conduit had to be emptied while work was in progress, but be used daily to supply the city. This necessitated 20 shut-downs and elaborate procedure with valves, pumps, etc. in emptying and filling.<sup>E46</sup>

#### An Iron Standpipe Ablaze

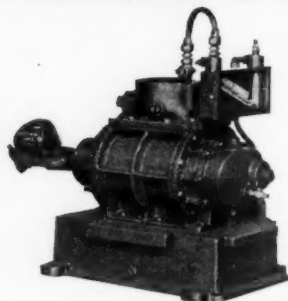
In repainting the inside of an iron standpipe in South Portland, Me., 36 ft. diameter and 77 ft. high, built in 1893, it was first covered with a priming coat, then with a coat of hot bitumastic enamel. When the latter was nearly finished a small amount of gasoline, used by the workmen to clean their hands, caught fire and in a few seconds the inside of the standpipe was a roaring furnace. The four men inside escaped with only minor burns. All the enamel was burned off. After the tank had cooled, the inside was scraped, washed and prime coated and filled with water to test for leaks. None were found, and the outside was wire brushed and painted with aluminum, and the inside with bitumastic enamel.<sup>G39</sup>

#### An 11-Acre Concrete Reservoir Roof

Sunset Reservoir, of the San Francisco water department, capacity 93,000,000 gal., is lined with 13 acres of 6

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in. reinforced concrete and covered with a concrete roof supported on columns 30 to 35 ft. tall, spaced about 25 ft. centers in both directions. The roof deck is of pan construction, with 2.5 in. slab, and 5 x 14.5 in. joists spaced 30" apart and framed into reinforced concrete beams supported on the columns. All concrete was vibrated, and 4" slump was the maximum allowed in lining concrete. Bottom and slopes were poured in alternate panels. A copper-sealed expansion joint was placed at the junction of the bottom and side slopes. After the lining had been cured for several months, the cracks that developed at the slab joints were blown out and cleaned with chloride of lime solution, and a grout of waterproof plastic cement forced into the joints and seal coat of the same  $\frac{1}{4}$ " thick spread over them. A liquid curing compound was sprayed on both lining and deck concrete. Cost of the 36,000 cu. yd. of concrete, including fine grading for same, \$794,000.<sup>15</sup>

#### Composition of Pure Water

Water consists, not of  $H_2O$ , but of 33 substances, of which, besides O, the most important is "heavy hydrogen" or deuterium (D) which has an atomic

weight twice that of hydrogen. There are also two heavy oxygens, one with an atomic weight of 17, the other of 18.  $D_2O$  differs from  $H_2O$  both chemically and physically and is found in appreciable amounts, which none of the others are. It boils at a little higher temperature. Seeds will not sprout in it, and animals given only "heavy water" to drink die of thirst, but it is not poisonous, only inert.<sup>128</sup>

#### Typhoid Death Rates

Urban typhoid death rates in 1937 showed new lows in five of the eight geographic divisions of the country; Middle Atlantic 0.51 per 100,000; East South Central, 2.10; West North Central, 0.76; West South Central, 2.34; Mountain and Pacific, 0.68. Of the other three, New England had a rate of 0.45 (0.42 in 1936); South Atlantic, 1.96 (1.55 in 1936); East North Central, 0.62 (0.60 in 1935). Taking the country as a whole, the rate in 1937 was 0.76. That in 1910 was 20.54, and for all but 4 of the 28 years 1910-1937 each year has shown a decrease from the previous one. Last year, of the 93 cities included in the record, 27 had no typhoid deaths. Two of these

have had no deaths in 4 yrs., one none in 3 yrs., and 5 none in 2 yrs.<sup>131</sup>

#### Automatic Valves

Automatic valves are used in water works for control of air, rate of water flow, and water pressure; the last including float valves, automatic check, emergency shut-off, pressure reducing, relief or back pressure, surge, altitude, and combination of 2 to 6 functions. Hydraulic control can be made from a remote point; pilot control is economically practicable for only about 1200 ft. Pressure-reducing valves may be differential, spring-loaded, lever and weight, or pilot operated. Back-pressure valves may be spring loaded up to 2" size, but pilot operated are preferable for larger sizes. Altitude valves may be single acting (closing to prevent overflow of tank), or double acting (also opening to discharge from tank to distribution). A good automatic valve should function irrespective of varying conditions; operate without inducing water hammer or surges, for flows from 0 to maximum; be easily adjusted, constructed of suitable material, permit of easy repair, inspection, test and low maintenance cost, free from intricate me-

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#### Clay in Water Treatment

In Atlanta, Ga., regular use of clay, with alum, has increased efficiency of treatment 10 to 30%. Adsorbent clays improve alum coagulation on many waters having turbidity of about 100 ppm, and water filters crystal clear. Clay which has adsorbed chlorine tends to reduce putrescence, odors, and even coliform bacteria, in sedimentation basin sludge. It tends to remove color from water in proportion to the amount of clay used. That with geolitic properties has reduced total hardness. Most water-conditioning clays can be bought for  $\frac{1}{2}$  to  $1\frac{1}{2}$  cts a pound. When clay is applied to raw water, and carbon in the settled waters to the filters, they become complementary.<sup>A137</sup>

#### Upward-Flow Precipitation

At the Minneapolis softening plant, (Fridley station) the precipitators are the Spaulding upward-flow type; the outer wall forming the upper part of a

funnel, inside which is the lower part of a similar funnel inverted. The water flows down through the inside of the inner funnel to a shallow chamber beneath, is there stirred so as to keep water and sludge mixed, then rises between the two cones at a uniformly decreasing rate (which is kept at 2" just below the overflow weir), thus keeping the sludge in suspension without carrying any away. Sludge is withdrawn at intervals to maintain about an optimum amount in suspension—about 2% in the agitation chamber. This gives long contact and thorough mixing, with resulting complete action of chemicals on the water.<sup>A139</sup>

#### Meters in South Africa

Until 1915 Johannesburg used positive piston meters, but since then 40,000 American disc meters have replaced them, giving more satisfactory registration and costing less for purchase and repair. British manufacturers do not make these, but have developed a rotary piston meter competitive in price, of which Johannesburg has bought 5,000.<sup>D29</sup>

#### Bibliography of Waterworks Literature. The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; n, note or short article; p, paper before a society (complete or abstract); t, technical article.

A Journal, American Water Works Ass'n  
September

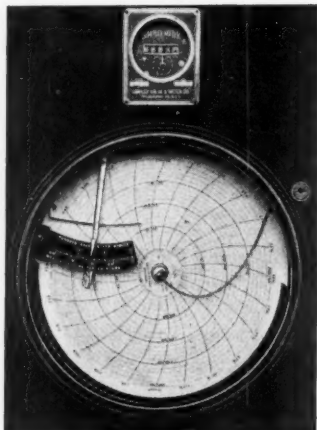
128. t. Water Isn't H<sub>2</sub>O. By A. M. Buswell. Pp. 1433-1441.
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130. Electrolysis Troubles. By J. B. Dean and D. D. Gross. Pp. 1451-1455.
131. Typhoid in the Large Cities of the United States in 1937. Pp. 1456-1470.
132. Recent Experiences in Sterilization of Distribution Systems. By B. A. Poole. Pp. 1471-1477.
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134. A Unique Iron Removal Plant. By P. Ley. Pp. 1493-1506.
135. Pressure Filters for Iron Removal. By R. S. Charles. Pp. 1507-1513.
136. Automatic Valves. By W. F. End. Pp. 1514-1527.
137. The Use of Clay in Coagulation and Taste and Odor Control. By P. Weir. Pp. 1528-1539.
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30. London's New Water Examination Laboratories. Pp. 407-408.
31. Nuneaton Reservoir and Water Tower. Pp. 415-416.

E Engineering News-Record  
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44. Finding Leaks in Water Mains. Pp. 431-432.



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2. Old Cast Iron Pipe Salvaged at Highland Park, Texas. Pp. 3, 4, 15.

tions of the spillway, from buttress to buttress, beginning 2.5 feet below the tread of the first (bottom) full step and continuing for the full height of the steps to the spillway crest, except for the tread on one step and the riser of another (which previously had been experimentally gunited), comprising in all an area of approximately 25,000 sq. ft. and an additional area of 5,000 sq. ft. on the non-overflow portion of the dam and parapet walls.

Operations were carried on from the base of the dam, where the contractor's plant and equipment were set up. The procedure followed was briefly as follows: Loose and disintegrated surface concrete was first removed, which was then covered with 4" by 4" #6 steel wire mesh, securely fastened to the concrete by wiring to 1/4" expansion bolts set 24" center to center. Gunite, consisting of one bag of cement and 3 cu. ft. of sand, after a thorough mixing in a dry state, was placed under pneumatic pressure with a cement gun.

An average force of 18 men (maximum 32) was employed by the contractor for the 77 days work was in progress. Shooting of gunite took place on 43 days, with an average use of 108 bags of cement a day and a maximum of 207.

## Repairing a Spillway

During last fall and the spring of 1938, repairs were made to the spillway steps of Nepaug dam of the Hartford, Conn., water supply. A contract for the work was let for \$15,977.50, this contract providing for resurfacing with gunite the concrete steps and crest sec-

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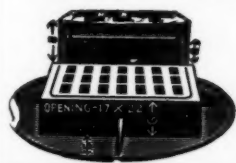
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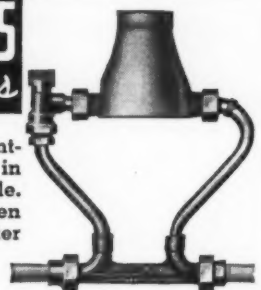
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## Pollution in the Ohio Basin

During the past three years there has been a concerted effort for pollution abatement on the Ohio river watershed. The U. S. Public Health Service, in summing the problem up briefly, says that pollution at Pittsburgh has reached the point where only the presence of acid mine drainage prevents nuisances in summer. But acid drainage, while decreasing the effect of pollution near the point of discharge, may cause excessive pollution down stream by delaying bacterial activity until dilution has removed the inhibitive action of the acid. The removal of large amounts of acid together with the normal increase of sewage and waste pollution will decrease this inhibitive action and tend to limit the effects of pollution from the Pittsburgh area to that vicinity, possibly producing nuisances. Pollution at Cincinnati and probably other points has at times, in the absence of acid drainage, caused oxygen depletion; and future increase in pollution may cause nuisance conditions along their waterfronts.

From the standpoint of public health, the greatest problem of existing pollution is its effect on public water supplies by (a) so overloading treatment devices that they pass intestinal organisms—a condition approached in the Ashland and Ironton area most of the time and several other places much of the time; and (b) producing intestinal irritants in the water, during long periods of pool stage, which are not removed by filtration; and as pollution increases, this may happen more frequently at times of more nearly average summer flow.

The solution of these problems, resulting mainly from the solid material and the bacteria of the sewage and industrial wastes, would appear to be in their removal, the solids by methods of sewage treatment, the bacteria by disinfection.

## State Highway Expenditures and Income

During the year 1937 State highway departments spent \$551,979,000 on road construction (including right of way) and \$227,877,000 on maintenance. Of the capital outlay, \$19,704,000 was for acquisition of right-of-way, \$469,574,000 for construction of roads and \$62,701,000 for construction of bridges.

Classified according to the system on which expended, of the total capital outlay, \$457,866,000 was for primary state highways; \$27,190,000 for secondary roads under state control (twelve states only); and \$66,923,000 for urban extensions of the state system.

It appears that 12% of the total was used for these urban extensions. But the percentage varied widely with different states, from 0.5% in Virginia to 39% in New Jersey.

Maintenance figures include snow removal, highway signs, and maintenance of drawbridges and other utilities. The expenditures on primary state highways was \$182,036,000, or about 40% of the capital expenditures on the same class of roads. On urban extensions, the maintenance expenditures were \$5,929,000, or about 9% of the capital expenditures. On secondary roads the state expenditures for maintenance were \$39,912,000, or 46% more than for construction. North Carolina spent more than four times as much, West Virginia more than three times.

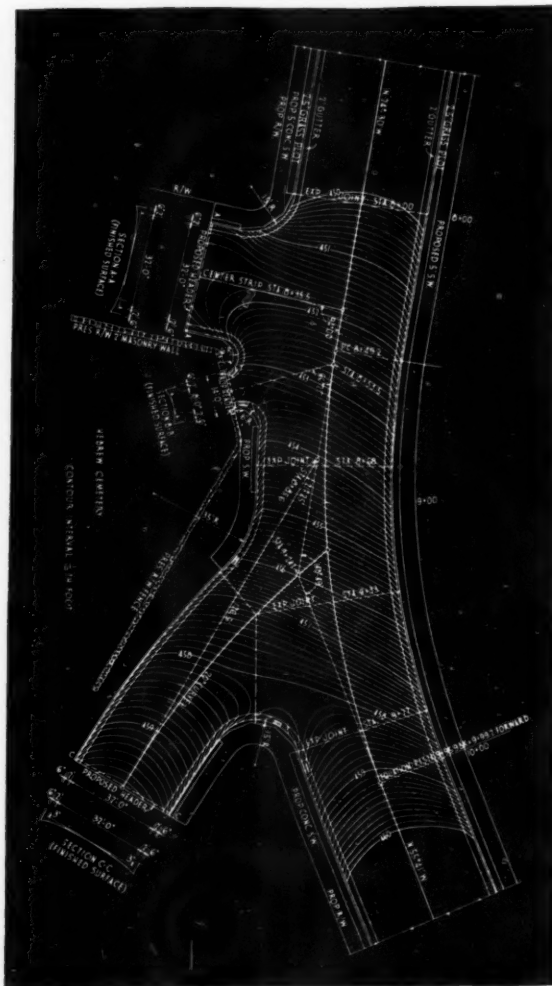
The states paid a total of \$65,824,000 in interest on state highway obligations, and \$75,664,000 in retirement of such obligations; and had on hand a balance

of \$413,104,000. Police, administrative, etc. brought the total to \$1,166,706,000, of which the Federal government contributed \$262,762,000. Income from state imposts on motor vehicle users was \$827,589,000.

## Contours to Establish Street Intersection Grades

When a highway department carries state or county roads through cities, it is faced with conditions and problems not found elsewhere, one of which is establishing roadway grades at street intersections. The Tennessee Department of Highways uses contours with 0.1 ft. intervals for this purpose.

Elevations along the centerlines of intersecting pavements are first calculated from established grades which have taken into account the elevations of adjacent sidewalks, buildings, etc. Elevations along the gutter lines are also calculated, using the above gradients and the established crown for the slab. Points of equal elevation are then connected by contour lines, which are straight for the gutter section (which has a straight slope) and curved for the parabolic crown of the slab itself. These contour lines are then inspected for "flat spots" or too steep crown, and are shifted as required to get an even, smooth-riding surface. The field forces can, from the contour lines, determine the elevation of any point in the intersection and set any grade stakes needed for subgrading or final pavement surface.





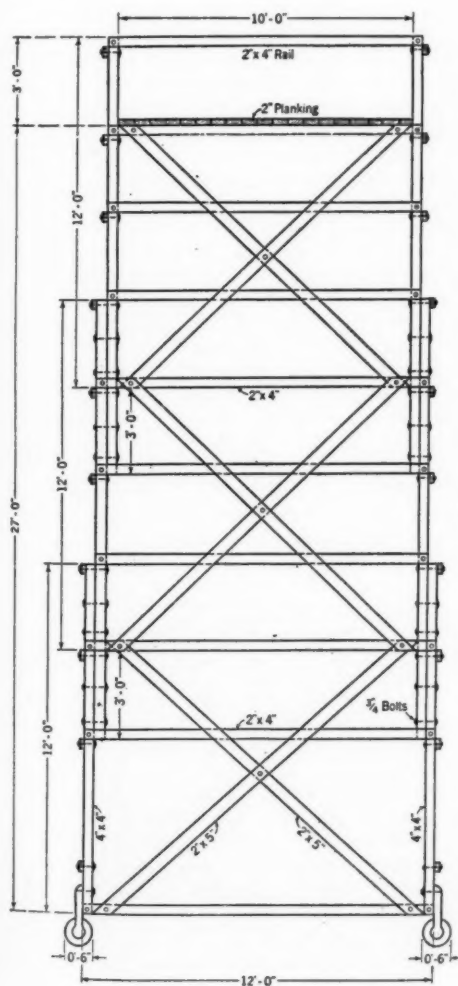
# Practical Kinks for the Engineer

Contributions to this page are invited. Send in your kinks.

Public Works will pay \$3 each for those published.

## Tobacco Can Makes Excellent Emergency Marker

It is quite frequently necessary to mark some particular spot or location for future use and reference, as a result of measurements or some other important connection at the time. A small stick or stake is of course generally made use of, but such are often unwittingly pulled up or removed by others unaware of their importance. An available and often handy marker is an old tobacco can. Rip off the cover and crush the mouth closely together forming a sharp wedge. Force this down into the ground. This can be repeatedly walked over without disturbing it; it is not liable to be pulled up or removed, and is readily covered lightly to conceal it if advisable. Makes a handy, ready and practical emergency marker for future use and reference.



Moveable stage for painting

## Stage for Painting Big Rooms

Getting at the surface to be painted is often a job. In the *Dutch Boy Quarterly*, the painting stage shown herewith, was shown. This was designed by Fred Elwell to paint the auditorium of the Salem, Mass., high school.

This stage is built of good, clear lumber, free from knots, and is held together with bolts, not nails. It can be used at any height between 12 and 50 feet. The stage is equipped with 8-inch ball bearing wheels to facilitate moving about. The working platform is designed to accommodate twenty men. Although the stage is strongly built, it can be taken apart for storage in three hours by three men. Its complete cost was in the neighborhood of \$200.

## Applying Adjustable Counter Balance Weights

Adjustable counterbalance or regulating lever weights are often needed for homemade trips, safety devices, and other controlling schemes, the adjustment of which must be quickly changed from time to time. The weights are not so hard to procure; from odds and ends in the form of washers to slip over any small rod are suitable. An arrangement to slide and fasten them there is usually the difficulty when without extensive tool or shop equipment. The photo shows such an affair made to regulate the amount by weight, of a compound mixed with water for a treating purpose. The lever was simply an old auto brake rod, 5/16" in diameter and threaded to take two old auto windshield adjuster post nuts. Between them was located two odd cast iron plates or washers, drilled to slip over the rod. The thumb or adjusting nuts made it very easy quickly to move the weights either way on the rod and to instantly and securely lock them in place.

## Keeping Desk Drawer Tabs or Markers Clean

The small lettered bits of cardboard or heavy paper, slipped in the metal sheath or holder of desk drawers, soon become soiled, as the thumb and fingers often unavoidably come in contact with them in handling, particularly those in the upper cabinet or part of the desk. A simple method of keeping them clean and bright is to wrap them before insertion as shown. The usual moisture from the hand or fingers will not adhere to this at all. The lettered pieces as a result stay clear



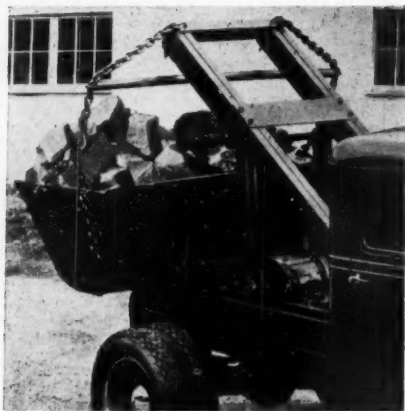
Above—Desk drawer marker. Middle—Tobacco can marker. Lower—Adjustable counterbalance.

and legible for a long time. Clean unwrinkled cellophane can of course be procured from many sources.

## Combination Winch and Sprinkler

One of the handiest pieces of equipment in the Yuma street department is one of those four wheel drive trucks distributed by the government after the big scrap and converted into a sprinkling tank truck. The powerful winch mounted under the rear end, with its 500 feet of cable is used frequently in pulling down trees, drawing other equipment out of tough spots or razing some condemned building. By filling the tank with water it is seldom necessary to anchor the truck in making the pull.

# Keeping Up With New Equipment



Helping the shovel man

## The Man With a Shovel—Making Him More Efficient

STREET work, sewer trenching, laying water mains, removing sludge from drying beds and many kinds of rural highway maintenance, employ the man with a shovel as the prime mover. These jobs are too small for a power shovel, or the community doesn't own a power shovel. The problem is to get power shovel costs with hand labor.

One of the factors in the cost of moving dirt by means of the man with a shovel is the time lost by the trucks waiting to be filled. It takes quite a while for a gang of shovelers to fill even

a small truck; and that truck is costing around a dollar and a half an hour—maybe more. A piece of equipment has been developed that solves this problem. This is a container that holds a cubic yard or more. A "litter" of these containers don't cost very much. The men shovel the dirt into the containers, and the truck comes along to pick these up and haul them away. The truck works *all* the time instead of just now and then. Four or five of these and one truck cost a lot less to buy and to operate than even two trucks. They are especially adapted to the small community, to town or county highway work, and for small contractors. Brooks Equipment & Mfg. Co., 56 Davenport Road, Knoxville, Tenn., can arrange demonstrations in most sections and will send you data showing how this equipment has saved money—and how much—in other communities.

## 24 Tons on a Trailer

A 6-wheel, balloon tired, trailer to handle loads up to 48,000 pounds has been developed by C. R. Jahn Co., Chicago, Ill., for handling heavy machinery, as shovels, concrete mixers, etc. A feature is the front-end loading, the front end of the trailer frame serving both as a connection and as a turntable. The trailer meets all state regulations covering overall lengths, widths and wheel designs. Fuller data on request.



12-yd. Le Tourneau Carryall Scraper, with U. S. Earthmover tires, on 10 miles of highway grading in eastern S. Dakota. David Gustafson, Sioux Falls is the contractor.



Barco gasoline powered drill employs the same general principles as those used in the Barco gas hammer

## Barco Portable Gasoline-Powered Drill

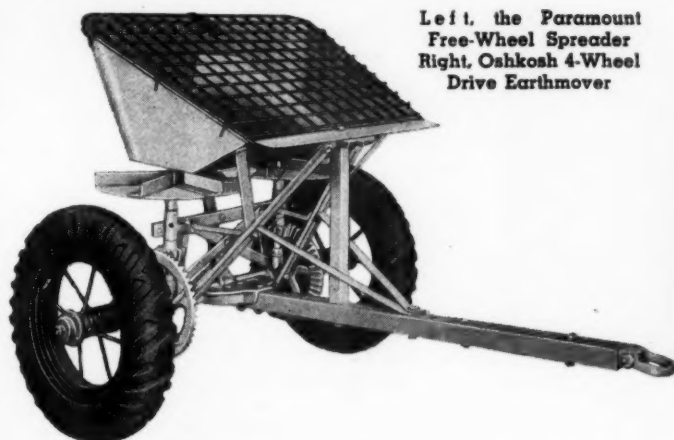
FOLLOWING exhaustive tests on actual drilling operations conducted on all types of jobs and under a wide variety of working conditions, the Barco Manufacturing Co. of Chicago, Illinois, announce full time production on their newly designed, self-powered, instantly portable "J-2" driller.

This unit is designed as a driller, pure and simple, incorporating the drill-turning mechanism directly in the base of the power unit. Thus it is able to strike a full, direct blow, delivering all its power at the drill head, operating at the minimum of cost. It is light in weight, enabling the operator to carry it to the most inaccessible jobs, and instantly ready for work under its own power.

Literature regarding this new driller has been prepared and can be obtained either by writing to the factory and general offices of the Barco Mfg. Co. at 1801-15 Winnemac Ave., Chicago, or from any of the company's local dealers.

## Tractor-Crusher Units

THESE portable and inexpensive crushing plants make possible the utilization of stone and similar road materials found along the roadway, salvaging this into surfacing metal at a very low production cost. Especially adapted to rural roads and to trails in park and forest areas. Iowa Mfg. Co., Cedar Rapids, Ia., has issued a new bulletin, RC-2, which describes a broad and complete line of these units. Your own tractor will haul and operate one of these. Also made with conveyor or skip loaders. Excellent and useful booklet on request to the manufacturer.



Left, the Paramount  
Free-Wheel Spreader  
Right, Oshkosh 4-Wheel  
Drive Earthmover



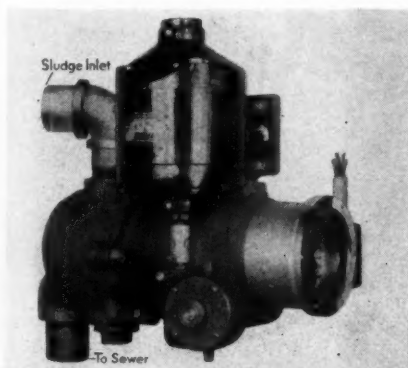
### A Free-Wheeling Spreader

ON road work, materials aren't any good in a pile—they have to be spread. The Paramount spreader is a light unit that will handle crushed stone, cinders, sand, powdered asphalt, calcium chloride and salt. Mechanism is out of gear when towing. Quickly attached or detached. Standard telescopic hitch for trucks. Volume of material is quickly and accurately controlled by slides in the bottom of the hopper. To facilitate using run-of-bank gravel, a 2-inch screen can be attached to reject oversize. Spreads 15 to 18 feet wide, depending on speed of truck. Agitators keep the material stirred up and free-flowing, so that no bridging of wet materials will occur. Described in booklet. Peoria Steel & Wire Co., Inc., Box 52, Peoria, Ill.

### New Automatic Desludging Valve

DEVELOPED as a part for its hot process lime soda water softener in which sludge must periodically be removed from a settling tank. The Permutit Company, 330 W. 42nd St., N. Y., has placed upon the market an automatically operating valve for permitting the flow of sludge from a container by gravity or under pressure.

Automatic operation of such a valve is highly desirable because periodic desludging by hand is apt to be overlooked or postponed for such an interval as to impair the efficiency of operation. With automatic desludging this is accom-



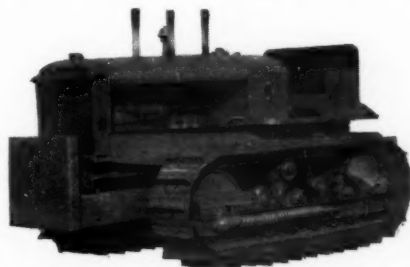
Permutit automatic desludging valve for hot process lime-soda softening

plished under precise control, assuring uniform conditions.

The valve is motor operated and of simple construction. Booklets are furnished upon request.

### Allis-Chalmers Pusher Attachment

TO increase scraper yardage and reduce loading time, the Allis-Chalmers Manufacturing Company, has designed a front-end bumper for its Model L-O tractors to be used for pushing tractor-scraper outfits while loading. Time studies on several jobs where these have been used show they increase payloads 2 to 3 cubic yards per trip, cut



Allis-Chalmers tractor with pusher

loading time in half and raise the daily output per scraper from a third to half. Users figure that a pusher will reduce tractor repair costs materially by relieving the pulling tractors of much of the twisting and jerking strains customary to loading. One pusher tractor can handle from three to five tractors and scrapers depending on the length of haul.

In addition to increased yardage and repair savings, Allis-Chalmers believes the use of the pusher will cut down operator fatigue by reducing the amount of gear shifting and steering clutch work now required to load scrapers where no pusher is used. Its use also provides an extra tractor for emergencies such as pulling equipment out of mud-holes, boosting trucks and scrapers up steep ramps, etc.

### 12 Speeds to Make the Earth Move

The Oshkosh 4-wheel drive earth mover, one of the newest developments in a utility tractor, is used principally in combination with self-filling scrapers. The tractor, however, is equally efficient

for the handling of end and bottom-dump trailer wagons which can be attached similarly to the scraper attachment, requiring approximately one hour for changing from one type of equipment to the other.

The tractor is equipped with a 176 HP diesel engine, 12 forward and 3 reverse speeds, combination hand and air power steer, applied to all four wheels through a new type steering geometry on which patents are pending.

The new method of handling dirt is to use this new earth mover with a scraper and a large tractor to assist in filling. The scraper has a rated capacity of 16 yards. The tractor has a speed of up to 35 miles per hour with brake equipment applied to all six wheels. The scraper is cable controlled.

### A Pocket-Size Drafting Machine

A NEW pocket drafter known as the "U-draft pocket drafting machine" is made by L. G. Wright, Inc., 5209-80 Euclid Ave., Cleveland, Ohio. This new instrument combines T-square, triangles, and drafting scales into a unique combination so that the instrument literally is a pocket size drafting machine. It is 7½" long overall and 1¼" wide.

The instrument consists of a graduated scale and a protractor head on which lines are inscribed at 15 degree angles to the horizontal scale. It is made of pyroxlin specially treated drawing instrument material and all of the scales are engine divided on the pyroxlin. A metal stiffener eyeleted to the pyroxlin keeps the instrument flat.

It is possible to make an accurate drawing 6" x 6" on any kind of paper. With the instrument, angles 15 degrees apart may be drawn and all lines may be drawn accurately to length. It is supplied in four different graduations as follows: full size and 1/16"; millimeters, full size and 1/10"; and also 1/8" and 1/4" to the one foot.

The tool is ideally suited for all types of mechanical drawings, cabinet drawings, installation diagrams, mathematical solutions, graphical calculations, floor plans, lettering, layouts, quick sketches, and dimensioning on larger drawings. It is likewise an excellent premium item for engineering salesmen to distribute. Full data on request.





Hanson "Comet" Shovel on FWD truck

### FWD-Mounted Hanson Shovel

THE Hanson Excavator Works, crane and shovel division, Hanson Clutch and Machinery Company, Tiffin, Ohio, announce a new truck shovel and/or crane mounting weighing only 12,500 pounds. The accompanying illustration shows one of several machines owned by the Ohio State Highway Department mounted on FWD trucks.

This Hanson, known as the "Comet" for truck mounting, is available as shovel, crane, clamshell or dragline equipped with Hanson patented Lockheed hydraulic controlled clutches and brakes, and with all shafts and moving parts operating in life-time ball bearings that do not require grease or oil at any time and/or Timken taper roller bearings requiring lubrication but once weekly (24 of these bearings).

The "Comet" is constructed so that, when as and if necessary, any clutch shoes or shaft assemblies may be removed without disturbing any other part of the machine. Simplicity and get-at-ability are featured in the design.

### 2 to 4 Miles of Traffic Line a Day

A NEW equipment for painting traffic lines, the Saylor-Beall line marking machine, manufactured by

Saylor-Beall Mfg. Co., Detroit, Michigan, is said to enable an inexperienced operator to lay down from two to four miles of accurate, clean-cut line, from two to six inches wide, in an hour, against the normal record of 700 feet per day by hand painting. In addition to traffic lines the equipment is designed to define playing fields, parking lots, airports, tennis courts, etc. Dual spray attachment is available for painting parallel lines. When equipped with extra gun, cup and hose, the outfit is useful for painting traffic guards, fire hydrants, street name signs, alarm boxes, etc.

The equipment consists of a single cylinder air compressor, driven by a gas engine, 12-gal. air-paint storage tank, pressure feed spray unit, all mounted on rubber tired, ball bearing wheels. Edges of spray are cut off by articulated shields, free to move vertically, making operation feasible over rough surfaces. Flow of material is regulated by operator through positive control trigger on guiding handle. The pressure feed feature is said to insure a deep-penetrating, long-wearing line, and the atomization a saving in material. Thorough cleaning without dismantling is provided for with an auxiliary cleaning tank. The outfit weighs 150 lbs.



Left: Saylor-Beall Line Marker

Right: Allis-Chalmers Speed Maintainer



### Composition Blades for Compressors and Pumps

YEOMANS Brothers Co., Chicago, have introduced into their rotary air compressors and dry vacuum pumps composition blades for the steel blades used heretofore. The composition blades are made of phenolic material which is very tough and hard and yet enough softer than iron or steel so that with the blade edges running on the bore of the cylinder there is no wear of the bore or any other parts of the housing or rotor due to blade contact.

Both cylinder and blades rapidly acquire a high glaze with consequent low friction losses, perfect seal and high efficiency, and the construction of the machine is greatly simplified with resultant increased life and reduced maintenance and repair costs.

In the prolonged shop tests made with this type of blade, there was not a single case of blade breakage, and it is of interest to note that if one of these composition blades does break it is instantly pulverized and does no damage to cylinder or rotor, as would a steel blade. New bulletins with revised ratings covering these machines will shortly be issued.

### For Highway Maintenance and Finishing

ALLIS-CHALMERS Manufacturing Company, Milwaukee, Wis., has just announced the Speed Maintainer, a new finishing and maintenance tool designed for use of contractors, state, county and township highway divisions, park boards, city street departments and airports.

The Speed Maintainer is one-man operated and will maintain the average earth or gravel roads at from 3½ to 4¾ miles per hour. It is particularly well adapted to highway shoulder maintenance. Ability to turn in a 16-foot circle, makes it handy for fine grading between forms or for use in narrow alleyways. Originally planned for contractor use, the Speed Maintainer has proved a fast, low-cost means of breaking up big clods and leveling behind blade and elevating graders. It is mounted on pneumatic tires and has a top speed of 9 miles an hour.

Specifications: length of blade, 9 feet; height of blade, 13½ inches; blade clearance, 9½ inches; blade pressure, 3990 pounds; angular rotation, 70 degrees; weight, 4140 pounds.

### Keeping Opposing Traffic Apart

OUT in Los Angeles a new type of divider has been used for separating opposing traffic on a major highway—Ramona Boulevard. Two roadside guards were installed back to back, using one post for mounting and two brackets. The rails are 12 ins. wide, convex in shape and fastened to spring steel heat treated brackets. The two rails are placed 5 ins. apart; thus less space is required for this safety divider than for the average traffic line. Installation is made by excavating a hole in the pavement, setting the posts, bolting the brackets to the posts near the ground level, and then attaching the guards. All equipment is standard, so that any city or county can assemble it.

The Los Angeles installation was made under the direction of R. T. Dorsey, traffic engineer of the city of Los Angeles, Calif. The guard rail, brack-



Mr. Dorsey and others inspecting highway divider installation on Ramona Blvd., Los Angeles.



Using Flexrock bonder.

ets and posts were furnished by the United States Spring & Bumper Co., also of Los Angeles.

### A Bonding Material for Concrete

A NEW primer for bonding materials to concrete has been developed by Flexrock Co., 800 N. Delaware Ave., Philadelphia, Pa. This primer is processed with cellulose. The application is simple. From 10% to 30% of water is added, and it is then applied with a brush. It is claimed that it will securely attach linoleum, rubber, tile, etc.



New Ingersoll-Rand Diesel Engine.

**Is this the book  
YOU have been looking for?**

## WATER SUPPLY AND PURIFICATION

By W. A. Hardenbergh,  
Asso. Editor PUBLIC WORKS

A brand new book on water supply and purification that the practicing engineer and water works superintendent will find meets their needs.

A most valuable text because it covers every phase of water supply, from both theoretical and practical viewpoints.

Design problems are explained and then illustrated by means of worked out examples. For instance, the design of a distribution system is made clear by the working out of a problem so arranged that the principles and methods can be applied to your own job. The Hardy Cross method of determining flow in a distribution system is explained in detail, with sample problems, completely worked out.

The engineer or superintendent will find this a most useful book—one that will make it unnecessary to refer to other texts in working out water works problems. Especially valuable to the superintendent to help him in his daily problems.

It contains 31 chapters, covering consumption; rainfall, runoff, evaporation, etc.; surface water,

ground water; reservoirs; pipes and conduits; laying pipe; planning a distribution system; designing distribution systems; pumps and pumping; water tests and analyses; treatment of water; softening; control of corrosion; disinfection; taste and odor control; how to design a treatment plant. 458 pages; 148 illustrations. \$4.

If you are like many other engineers, this is just the book you have been looking for. Send \$4.00 for a copy today. If not more than pleased with it you can return the book within 10 days and receive your money back.

### USE THIS COUPON

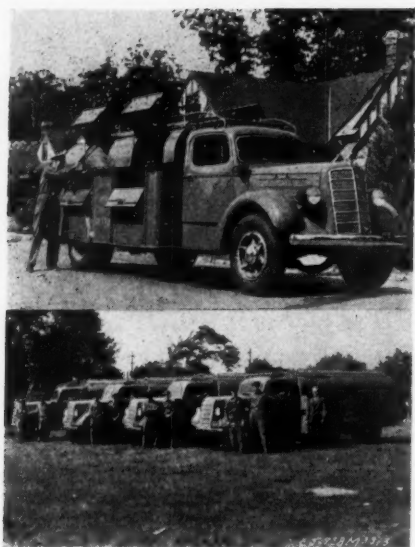
Book Dept. PUBLIC WORKS, 310 East 45th St., New York, N. Y.  
Enclosed find \$4.00 for which send me WATER SUPPLY AND  
PURIFICATION by Hardenbergh. If not satisfied I may return  
book in 10 days and you will refund my money in full. 11-38

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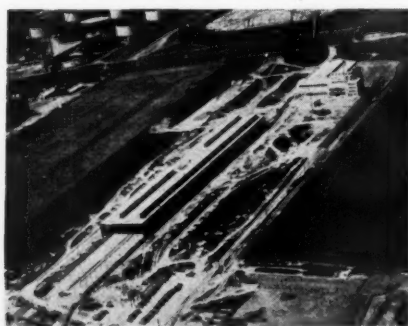




Some views of Rockville Center's refuse collection equipment

### Another City Goes Modern in Sanitation

THERE are few things that please this editor more than to see a city discard its antiquated equipment for refuse collection, and get something that: 1. Lessens the strain on the men who have to carry and load refuse, ashes, etc., into trucks; 2, prevent ashes, paper and other waste materials from blowing or falling into streets; and, 3, looks like sanitary equipment. Rockville Center, L. I., has just added four new units for ash and refuse collection. These are a long step from the decrepit acting and worse looking equipment so often employed on this service. They have two compartments, one for ashes with 4½ cu. yds. capacity, and one for garbage, with 7½ cu. yds. capacity. The roofs have a railing so that boxes, crates, etc., can be carried on them, but we hope that this won't be necessary for it will spoil the neat and sanitary appearance of the unit. We also hope that frequent coats of paint will be available to keep these units looking like they do now. These four trucks handle an average of 125 cu. yds. of refuse and 35 cu. yds. of ashes daily. Trucks by Mack; bodies by Gar Wood. Congratulations to both.



This new Johns-Manville plant at Watson (Los Angeles) Calif., is turning out transite pipe, electrical conduit, flue pipe, vents and stacks. The plant cost a million dollars

### Hard Rubber Pump for Acids

This is a hard rubber rotary gear pump which will handle acids and other corrosive chemicals, as alkalis, and their solutions. It is mounted on a cast iron base finished with hard rubber paint, and has a hard rubber drip pan. Capacity 8 gallons per minute, net weight 55 pounds. Driven by a ¼ hp. motor. Suction and discharge each 1 inch. Ralph B. Carter, Hackensack, N. J.

**Safer Highways.** — Many small bridges are unsafe—weak structurally, narrow or inadequate. How to replace them, making roads safer and saving on maintenance is the theme of this small publication. Armco Culvert Mfrs. Assn., Middletown, O.

**By-Ways to Highways.**—A remarkably fine 32-page booklet which describes the application of the complete line of Allis-Chalmers speed patrol graders and maintainers to highway work. Allis-Chalmers Mfg. Co., Tractor Division, Milwaukee, Wisc.

**25-h.p. diesel tractor.** — Operating costs and specifications of the Caterpillar D2 tractor are given in Booklet Diesel D2, published by Caterpillar Tractor Co., Peoria, Ill.

### STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933.

OF PUBLIC WORKS, published monthly at New York, N. Y., for October 1, 1938.

State of New York }  
County of New York } ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared J. T. Morris, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the PUBLIC WORKS and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Public Works Journal Corp., 310 East 45th St., New York, N. Y.; editor, A. Prescott Folwell, 310 East 45th St., New York, N. Y.; managing editor, none; business managers, J. T. Morris, 310 East 45th St., New York, N. Y.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Public Works Journal Corp., 310 East 45th St., New York, N. Y.; J. T. Morris, W. A. Hardenbergh, Croxton Morris, A. Prescott Folwell, Anna Morris, all of 310 East 45th St., New York, N. Y.; W. A. Hardenbergh, Golf, Ill., and Sumner N. Hume, address unknown.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) Bertha Morris, White Plains, N. Y.; Elizabeth Hardenbergh, White Sulphur Springs, N. Y.; Mary Sunderland, Liberty, N. Y.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name and address of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is: (This information is required from daily publications only.)

J. T. MORRIS, Business Manager.  
Sworn to and subscribed before me this 6th day of October, 1938.

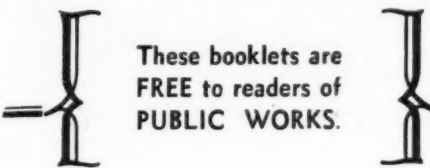
CROXTON MORRIS  
Notary Public, Westchester County, N. Y.  
Cert. filed in N. Y. Co. No. 879, Reg. No. 9-M-549  
Commission Expires March 30, 1939  
(Seal)

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### Flow Meters

389. The primary devices for flow measurement—the orifice, the pilot tube, the venturi meter and others—and the application to them of the Simplex meter are described in a useful 24-page booklet (42A). Simplex Valve and Meter Co., 68th and Upland Sts., Philadelphia, Pa.

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390. An 84-page catalog gives full design data, information about and illustrations of the complete line of Darling Gate Valves and Hydrants. Write for one to Darling Valve and Mfg. Co., Williamsport, Pa.

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### Pipe, Cast Iron

406. Data on cast iron pipe for water works systems, in sizes from 1½ to 84 inches, including information on useful life, flow data, dimensions, etc., Thos. F. Wolfe, Cast Iron Pipe Research Ass'n, 1013 Peoples Gas Bldg., Chicago, Ill.

### Pipe, 2-inch Cast Iron

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### Pipe Forms

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### Pipe Joints, Sewer

415. How to make a perfect sewer pipe joint—tight, prevents roots entering sewer, keeps lengths perfectly aligned; can be laid with water in trench or pipe. General instructions issued by L. A. Weston, Adams, Mass.

### Taste and Odor Control

417. How, when, and where activated carbon can and should be used to remove all kinds of tastes and odors from water supplies is told in a booklet issued by Industrial Chemical Sales Div., 230 Park Ave., New York, N. Y. 77 pages, table, illustrations and usable data.

### Pumps and Well Water Systems

420. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps, fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for these three descriptive booklets. Layne & Bowler, Inc., Dept. W, General Office Memphis, Tenn.

### Pumping Engines

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### Run-off and Stream-Flow

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430. All about setting and testing equipment for Water Meters—a beautifully printed and illustrated 40 page booklet giving full details concerning Ford setting and testing apparatus for all climates. Ford Meter Box Co., Wabash, Ind.

### Rainfall Measurement

432. The measurement of precipitation, exposure of gauges, description of apparatus for measuring rainfall, both rates and amounts. Bulletin RG and Instruction Booklet. Julien P. Friez & Sons, Baltimore, Md.

### Screens

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440. Disposal of Municipal Refuse: Planning a disposal system; specifications. The production of refuse, weights, volume, characteristics. Fuel requirements for incineration. Suggestions for plant inspection, 45 pp., ill. Also detailed outline of factors involved in preparation of plans and specifications. Morse-Boulger Destructor Co., 202P East 44th St., N. Y.

### Swimming Pool Equipment

444. A new booklet "Essential Factors in the Design and Layout of Swimming Pool Systems," with data on filtration equipment, fittings, solution feeders, accessories, etc., is available from Everston Manufacturing Co., 213 West Huron St., Chicago, Ill.

445. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

446. 40-page Manual on swimming pools. Includes swimming pool layouts, specifications, etc., and details concerning Permutit Swimming Pool Equipment. Write The Permutit Co., Dept. G-4, 330 West 42 St., New York, N. Y.

### Treatment

450. Standard Sewage Siphons for small disposal plants and PFT Rotary Distributors are new catalogs recently issued by Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill. The latter catalog contains typical plans and many illustrations of actual installations.

453. New booklet on Link-Belt Circuline Collectors for Settling Tanks contains excellent pictures and drawings of installations, sanitary engineering data and design details. Link-Belt Company, 307 North Michigan Ave., Chicago, Ill.

### Water & Sewage Treatment Chemicals

500. Aluminum sulphate and ferric chloride for sewage coagulation, and these chemicals and ammonia, copper sulphate and others for water treatment. Information on uses and methods sent on request to General Chemical Co., 40 Rector St., New York, N. Y.

501. "Ferrisul for water and sewage treatment." What it is; what it will do for you and how to use it—a handy booklet issued by Merrimac Chemical Co., Everett Station, Boston, Mass.

### Valve Box Tops

475. "Cut the Cost, but Not the Pavement." Is the theme of a new bulletin on Rite-Hite Valve Box Tops. Gives directions for forming new tops on valve boxes, quickly and inexpensively without digging up the old box. Just issued by Trohng's Supplies, Inc., 205 Hoyt Ave., Mamaroneck, N. Y.

### Water Works Operating Practices

490. "What Is New In Coagulation" is an excellent, new review with bibliography and outlines of latest work done in the field. Written by Burton W. Graham and sent free on request to Activated Alum Corp., Curtis Bay, Baltimore, Md.

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Brief reviews of the latest books, booklets and catalogs for the public works engineer.

### Taste & Odor Control:

The 5th anniversary number of this publication carries an excellent article on "Development of Activated Carbon in Water Treatment" by John R. Baylis. In addition to interesting information on the historical aspects of the use of activated carbon, the waterworks man will find the section on "Methods of Use" of value. Sent on request to Industrial Chemical Sales, 230 Park Ave., N. Y.

### Pump Handbook:

This 146-page engineering reference book on deep well turbine and low lift pump applications show practical pump applications for almost every class of pumping problem and discusses the engineering problems underlying design and operation. There is also a hydraulic engineering section of charts, tables, formula and other useful pumping data. This is an excellent and valuable text. We do not know if it is available generally; but we suggest that our readers request it on their letterhead, mentioning this item. Write Pomona Pump Co., Pomona, Calif.

### Military Preventive Medicine:

This is the third edition of a famous and valuable book. Its beginning dates back some ten years, when Col. Dunham started his monumental task of putting under one set of covers *all* the information available on the subject. This reviewer has had the pleasure of participating in a very small way in the preparation of these texts, and he is familiar with the contents.

For the sanitary engineer, there are large and complete chapters on water supply, waste disposal, insect control and other related subjects. These chapters are written in a clear and informative manner. This reviewer refers to them often for accurate information; what Col. Dunham has written can be relied on, always; and it can be understood. There is no hedging or pussyfooting.

While the treatment is always with the military situation in view, it must be remembered that in peace time the army operates many hundred water and sewage treatment plants—more in war time; that it designs and constructs such plants; that it has the problem of refuse collection and disposal; and also of fly and mosquito control. Therefore, the presentations are handled from the civilian angle, and additional material from the field service viewpoint is supplied.

Does junior have the mumps? Has there been scarlet fever in the school? Is there influenza in town? Military Preventive Medicine tells you how these dis-

eases are spread, the time of incubation, who is likely to be susceptible, precautions to be taken, and all the other information you would like to know but can't think of.

No, it isn't a "How to treat yourself at home." Not in the least. It is just the single most valuable book that exists on sanitation and preventive medicine, with additional material applying to military conditions. This fact along with its 1200 or more pages, makes it difficult to review at all adequately. Every sanitarian, every public health worker, every sanitary corps officer, and a whole lot of other folks ought to have it.

This book is in the non-profit class, and the author gets no royalties. It is published by the Army, primarily for the army personnel, but in recognition of its general value, it is available for sales through the Book Shop, Medical Field Service School, Carlisle Barracks, Pa., at \$2.50 per copy. It can also be obtained through the Book Service of the APHA, and through Public Works (for its readers only). The author is Lt. Col. George C. Dunham, Medical Corps, U. S. Army, Director, Department of Preventive Medicine, Army Medical School, Washington, D. C.

It might be added that Col. Dunham, then a major, sponsored the first classes in Military Sanitation at Carlisle, won the high regard and esteem of the sanitary engineers and sanitarians who formed the group; was adviser on sanitation to the Governor of the Philippine Islands for several years; is a charter member of the Order of the Boar; and has a greater capacity for work than anyone we know about.

### Water Works Accounting:

The Manual of Water Works Accounting was prepared and is being published jointly by the American Water Works Association and the Municipal Finance Officers Association. The committee which did the work was headed by Hal F. Smith, Department of Water Supply, Detroit, Mich., and M. F. Hoffman, Commercial Superintendent of the Cincinnati, O., water works. The material is divided into general heads, as follows: Accounting Organization and System; Customer Accounting and Collection; Expenditures; Assets, Liabilities and Net Worth; and Financial Statements and Financial Planning. The book is a complete and excellent text. It would certainly make the life of an editor easier if all water departments kept their data in the form suggested herein. As to the make-up, there are 145 figures, 12 tables, 9 charts and 470 pages. The "Terminology" section in the appendix is worthy of note. We do not have any price on this book, but it is worth whatever the price is.